US009373211B2

(12) **United States Patent**
**Rose, Jr. et al.**

(10) **Patent No.: US 9,373,211 B2**
(45) **Date of Patent: Jun. 21, 2016**

(54) **LARGE BOTTLE VENDING APPARATUS AND METHOD**

(71) Applicants: **R. Edward Rose, Jr.**, Hingham, MA (US); **R. Edward Rose, III**, Hingham, MA (US); **Michael James Verrochi**, Norwell, MA (US); **Jay Ray**, Hampden, MA (US); **Frank Dinoia**, Hampden, MA (US); **Bob O'Brien**, Hampden, MA (US); **Eric Quattrocelli**, North Brookfield, MA (US); **Warren Black**, Hampden, MA (US); **Ryan Horgan**, Northborough, MA (US); **Burleigh Hutchins**, West Brookfield, MA (US)

(72) Inventors: **R. Edward Rose, Jr.**, Hingham, MA (US); **R. Edward Rose, III**, Hingham, MA (US); **Michael James Verrochi**, Norwell, MA (US); **Jay Ray**, Hampden, MA (US); **Frank Dinoia**, Hampden, MA (US); **Bob O'Brien**, Hampden, MA (US); **Eric Quattrocelli**, North Brookfield, MA (US); **Warren Black**, Hampden, MA (US); **Ryan Horgan**, Northborough, MA (US); **Burleigh Hutchins**, West Brookfield, MA (US)

(73) Assignee: **BlueRock Ventures, LLC**, Norwell, MA (US)

( * ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 439 days.

(21) Appl. No.: **13/651,353**

(22) Filed: **Oct. 12, 2012**

(65) **Prior Publication Data**

US 2014/0103062 A1 Apr. 17, 2014

**Related U.S. Application Data**

(63) Continuation-in-part of application No. 13/407,452, filed on Feb. 28, 2012, now abandoned.

(60) Provisional application No. 61/654,585, filed on Jun. 1, 2012, provisional application No. 61/568,661, filed on Dec. 9, 2011, provisional application No. 61/560,835, filed on Nov. 17, 2011, provisional application No. 61/546,091, filed on Oct. 12, 2011.

(51) **Int. Cl.**
***G07F 11/00*** (2006.01)
***B65H 1/00*** (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ..... ***G07F 11/30*** (2013.01); ***G07F 7/0609*** (2013.01); ***G07F 11/28*** (2013.01); ***G07F 11/34*** (2013.01)

(58) **Field of Classification Search**
CPC ..... G07F 11/30; G07F 7/0609; G07F 11/28; G07F 11/34
USPC ..... 221/1, 288, 124, 66, 192, 312 R; 194/205, 212
See application file for complete search history.

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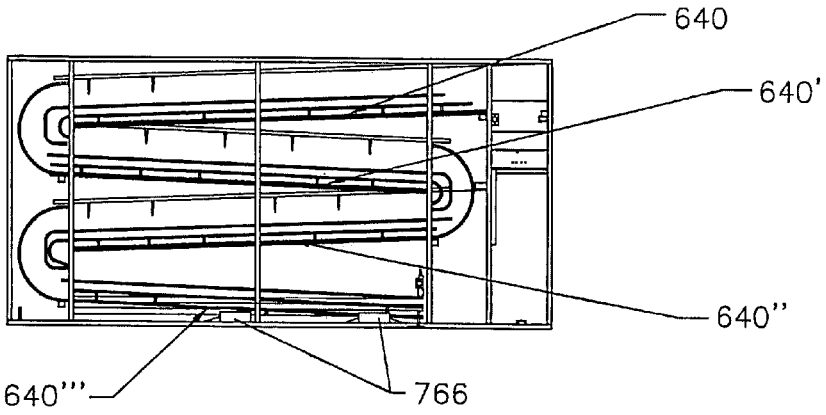
*Primary Examiner* — Rakesh Kumar
(74) *Attorney, Agent, or Firm* — Lorusso & Associates

(57) **ABSTRACT**

A combination vending/return apparatus and method. The apparatus includes a series of rows and columns for receiving, storing and dispensing unfilled and filled large-volume water-containing bottles from and to consumers. The apparatus includes a computer-operated vending keyboard for making bottle selections for purchase and returns, and to handle electronic payment and credit transactions. Also included is a method to vend large-volume water bottles and retrieve used and emptied large-volume water bottles.

**19 Claims, 115 Drawing Sheets**



(51) **Int. Cl.**

| | |
|---|---|
| ***B65H 3/44*** | (2006.01) |
| ***G07F 11/30*** | (2006.01) |
| ***G07F 7/06*** | (2006.01) |
| ***G07F 11/28*** | (2006.01) |
| ***G07F 11/34*** | (2006.01) |

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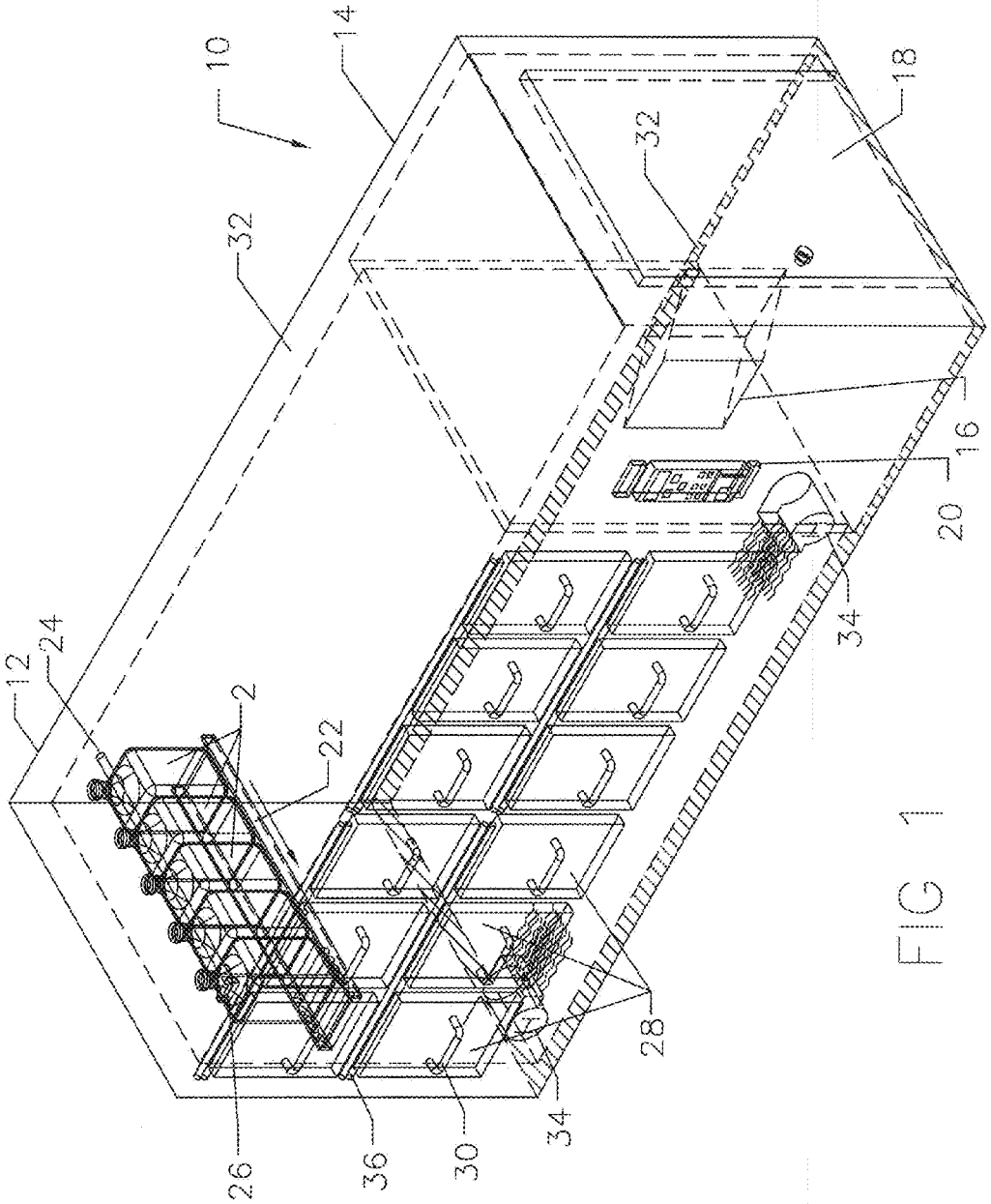


FIG 1

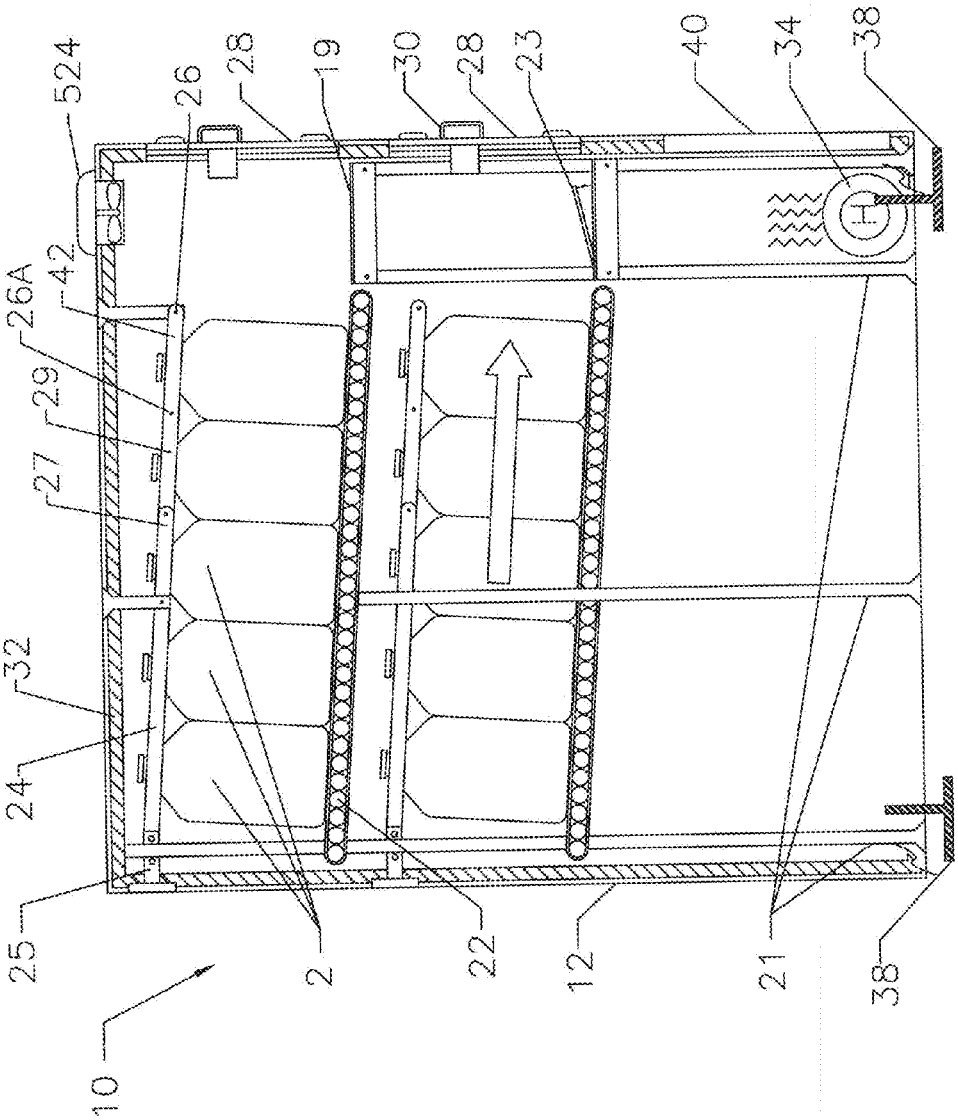


FIG 2

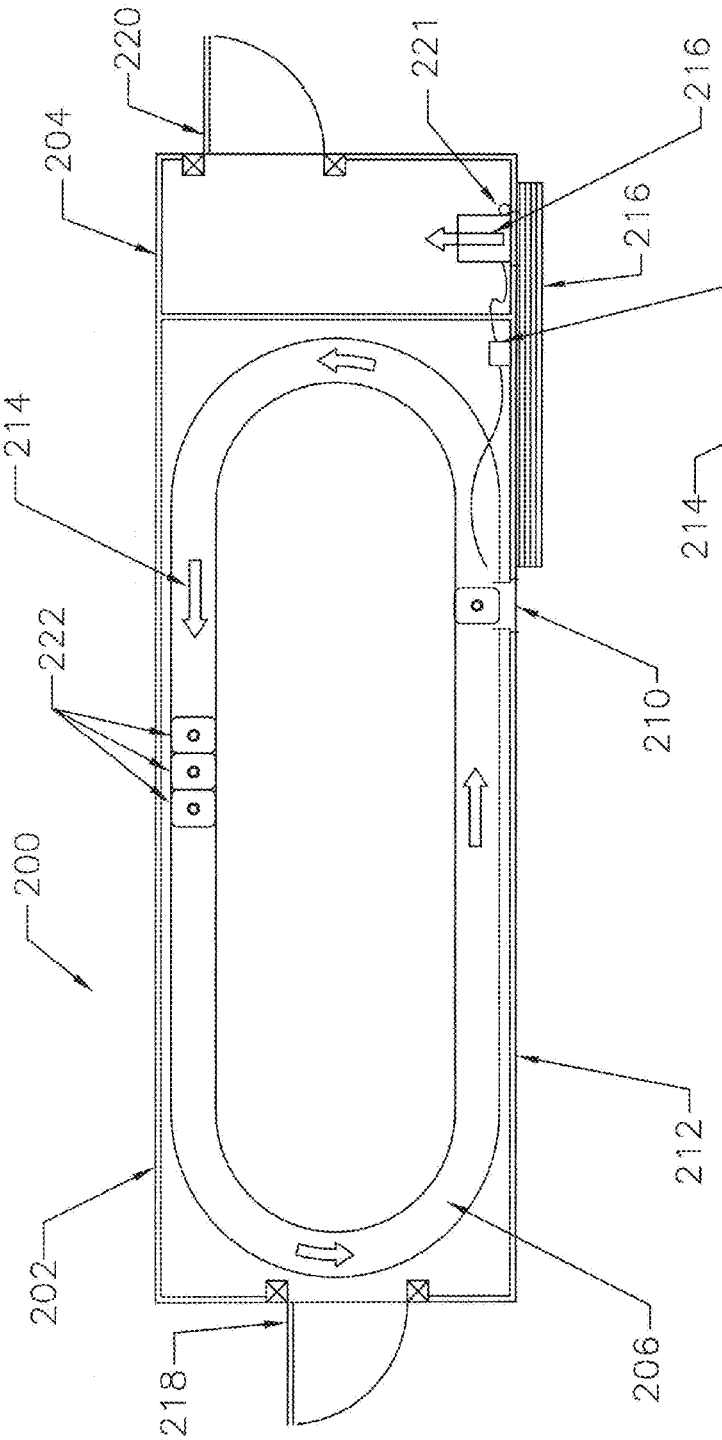


FIG 3

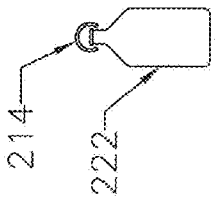


FIG 3A

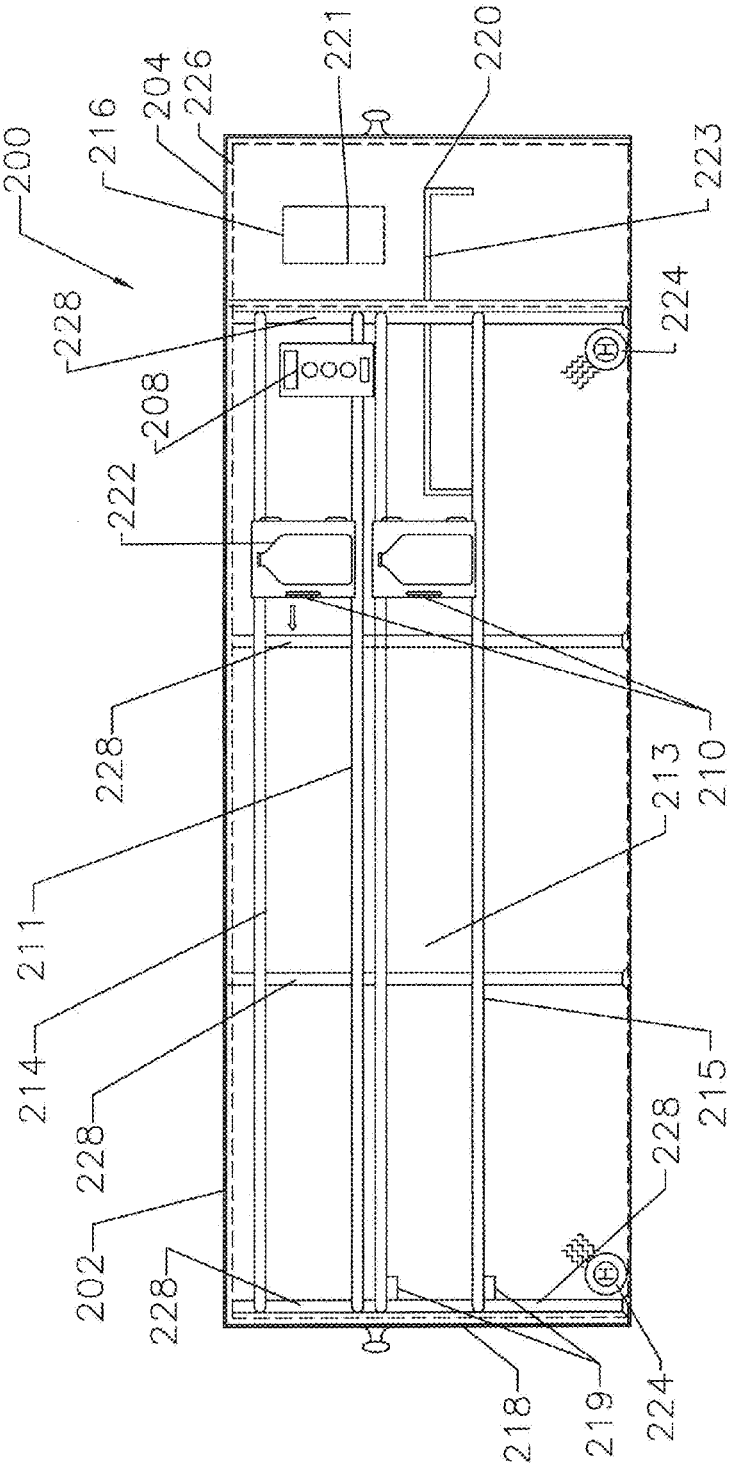
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FIG 4

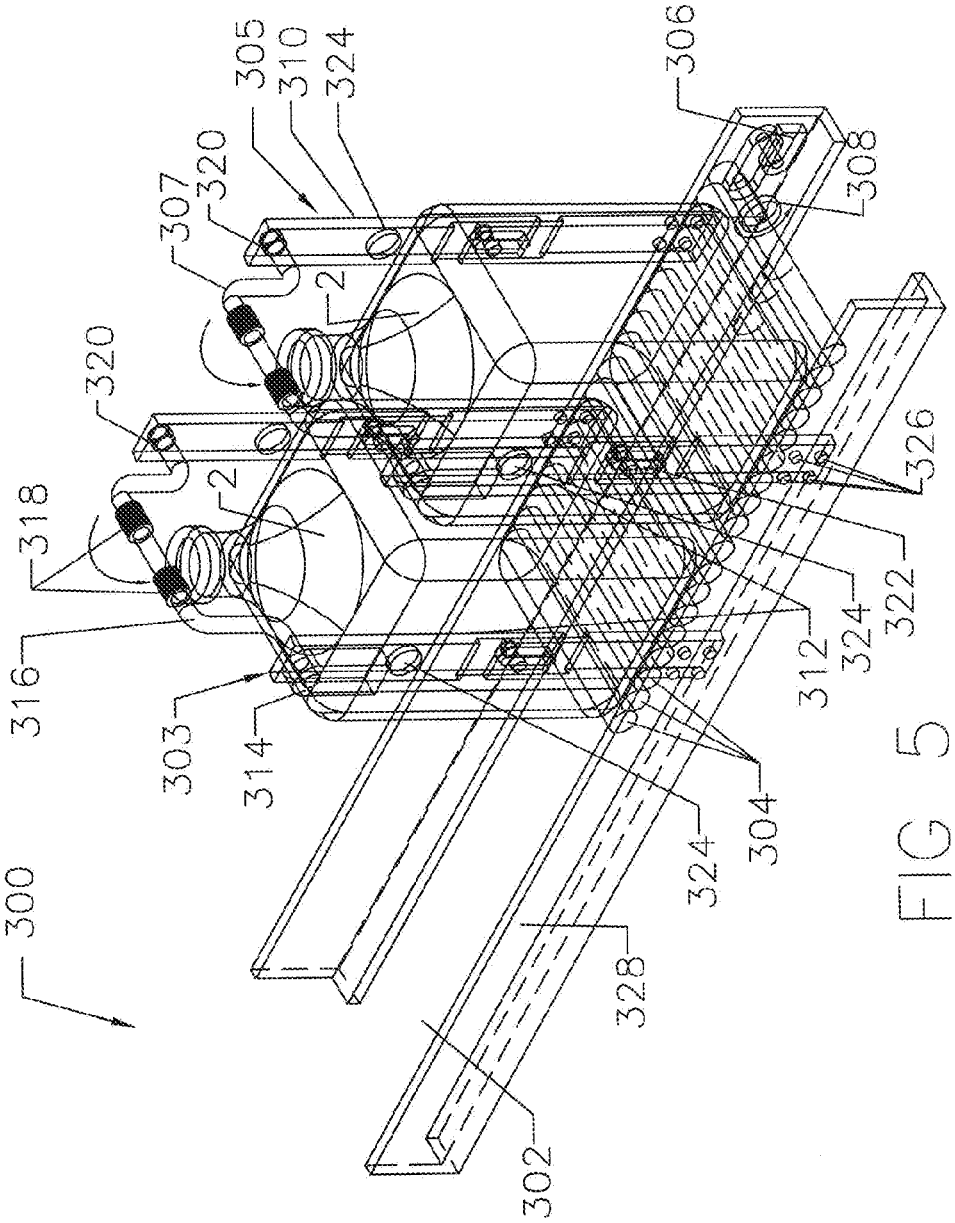
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FIG 5

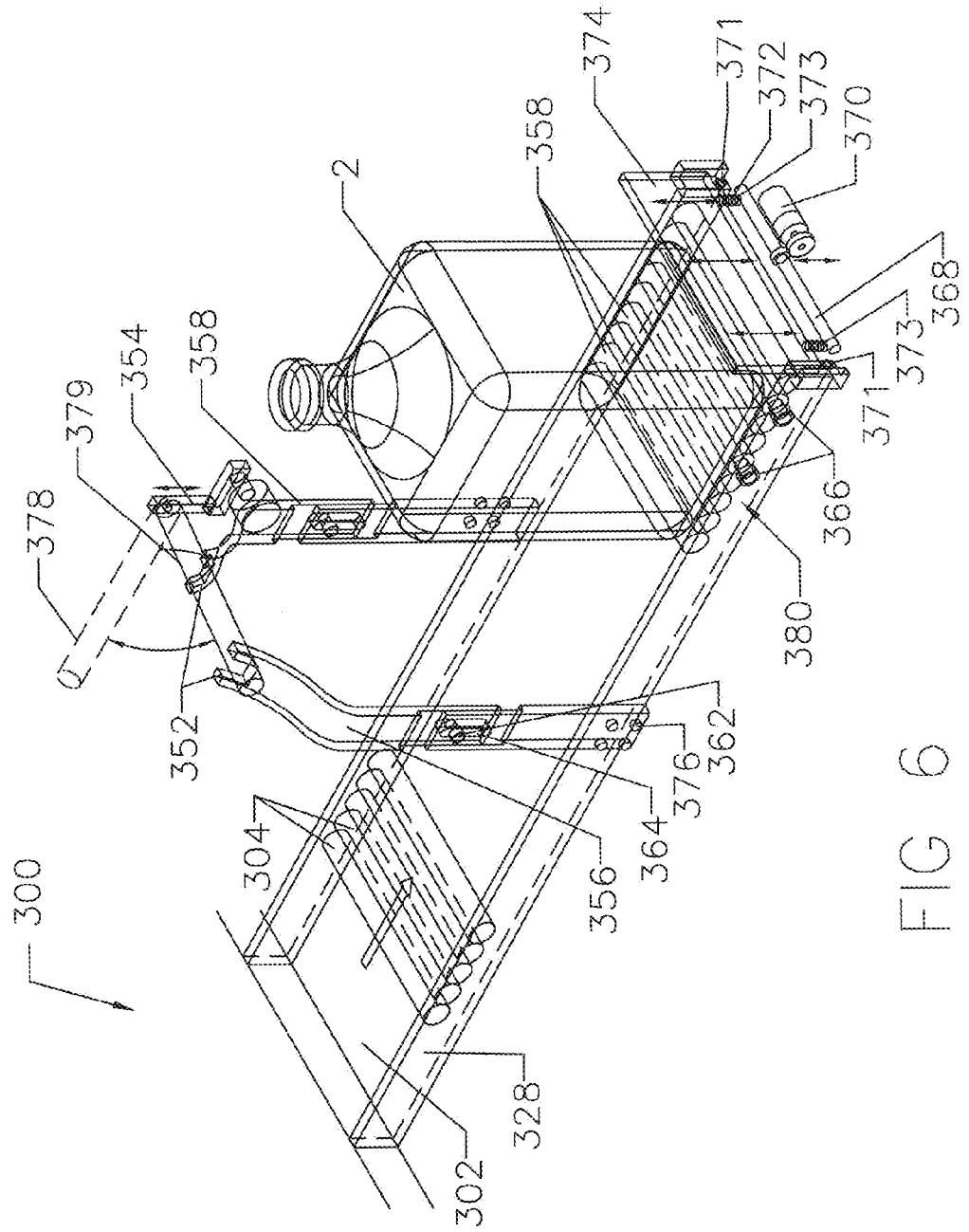
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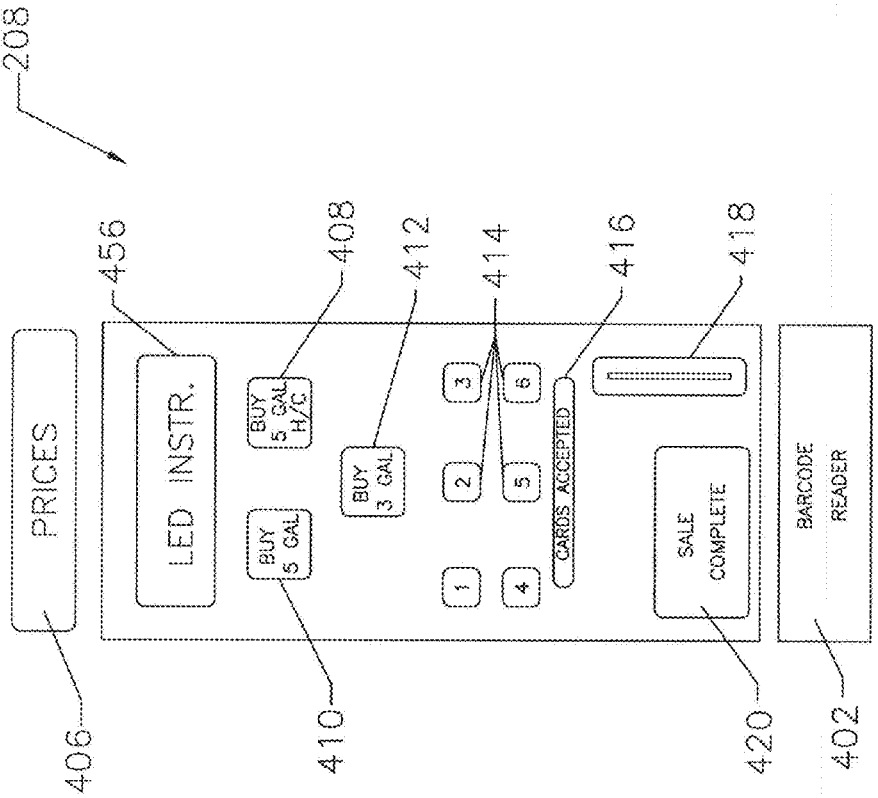
FIG 6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CARDS ACCEPTED
SALE COMPLETE
BARCODE READER
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FIG 7

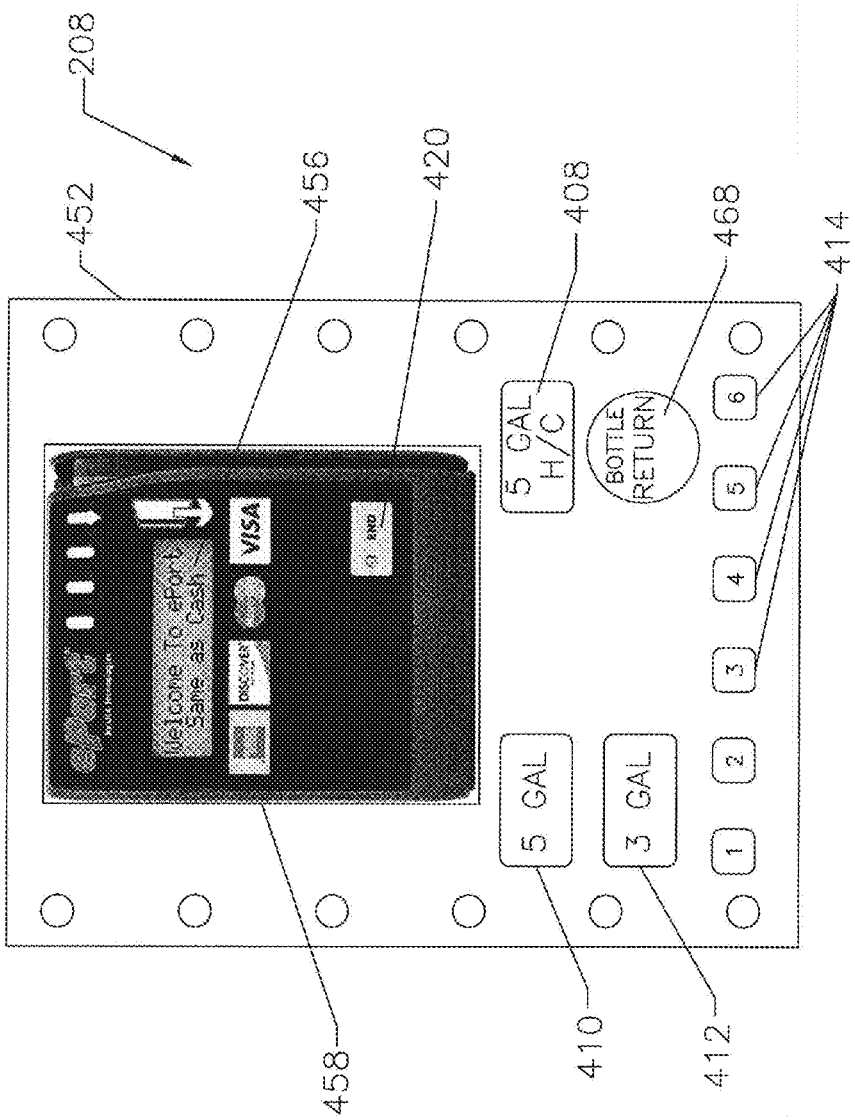
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FIG 8

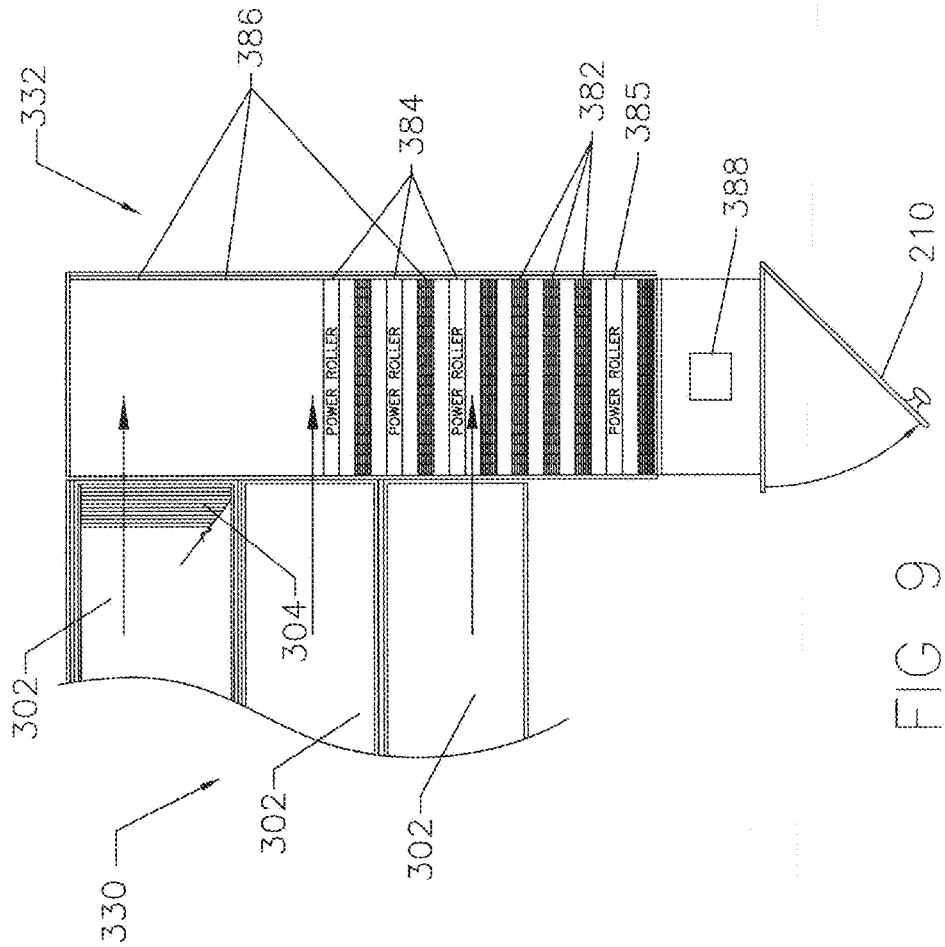
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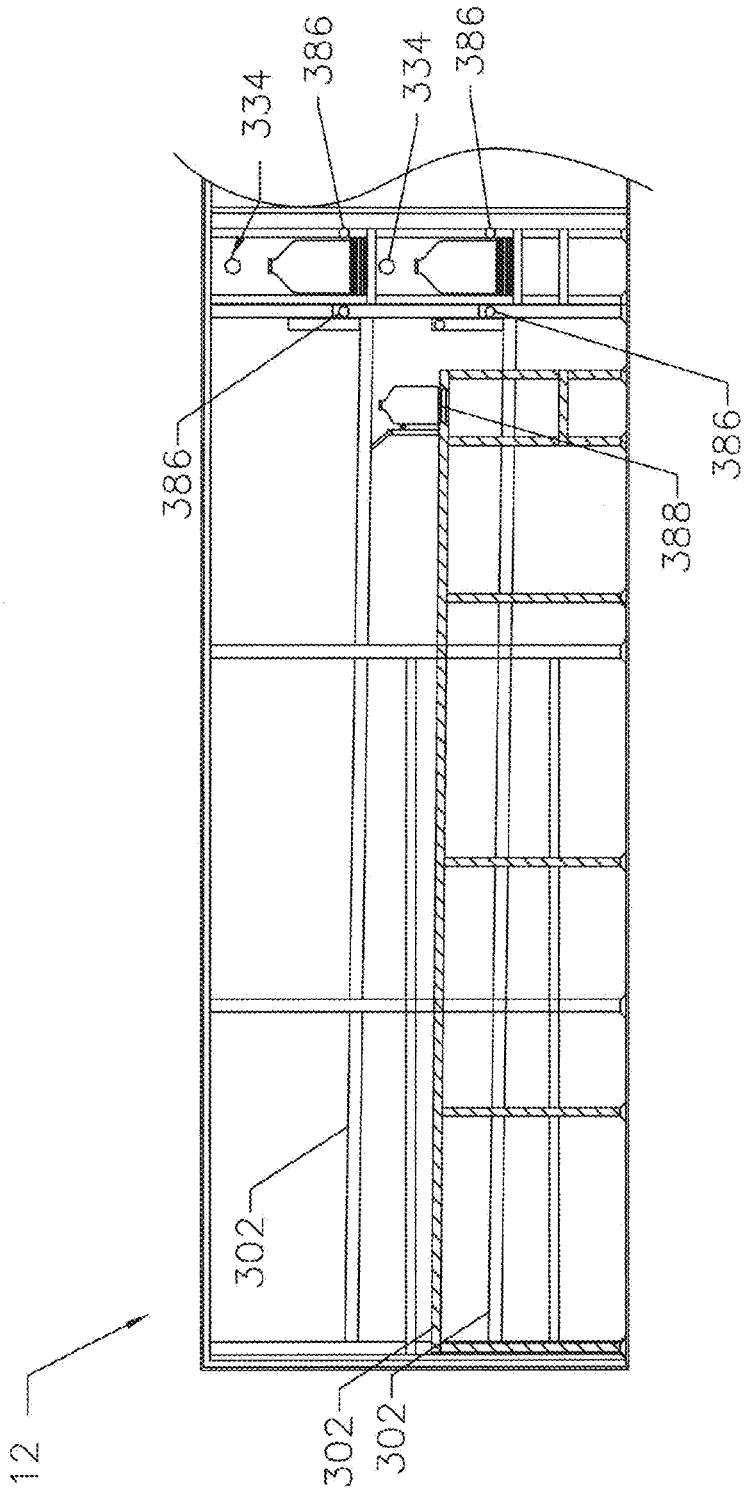
FIG 9

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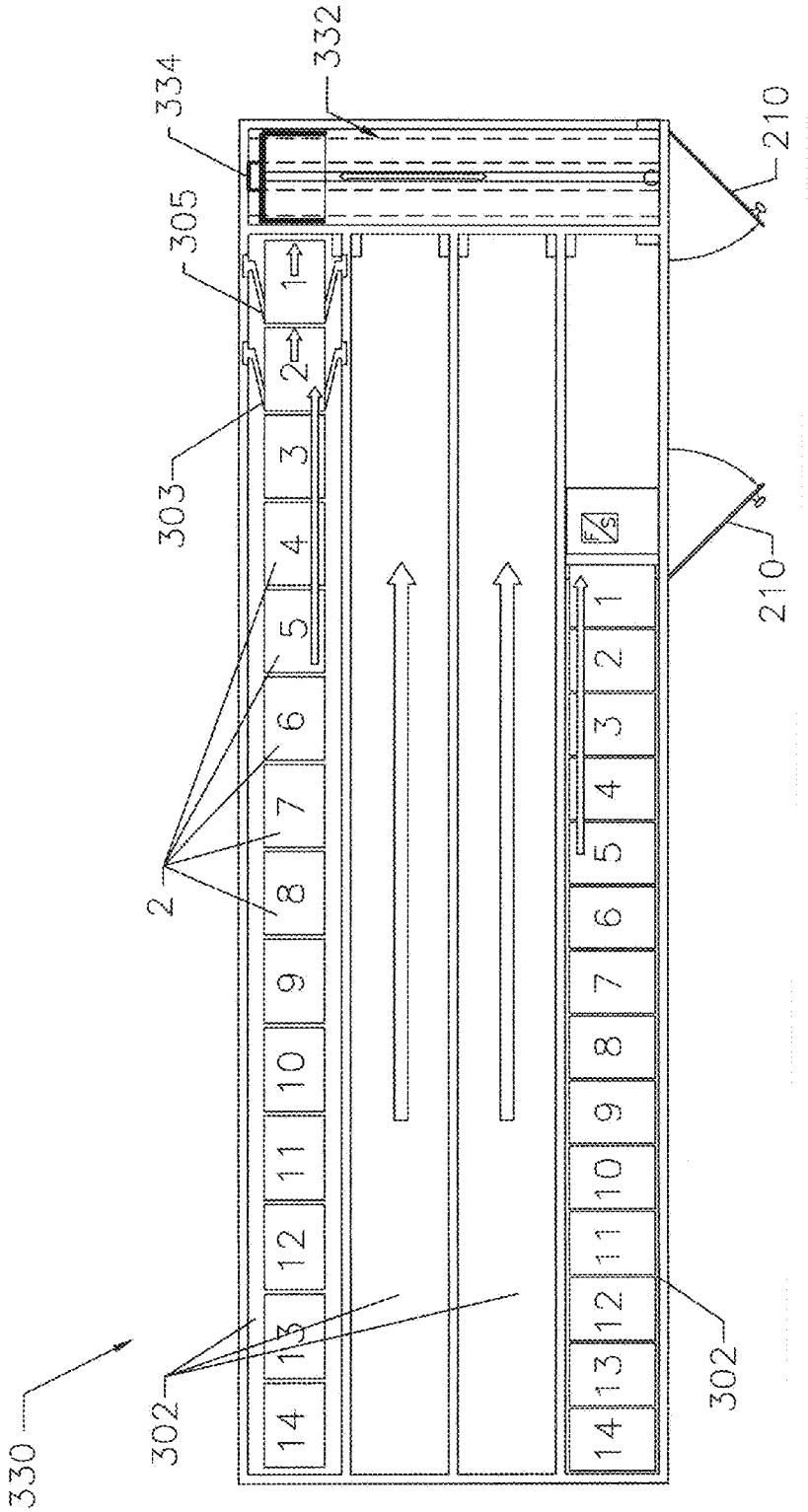
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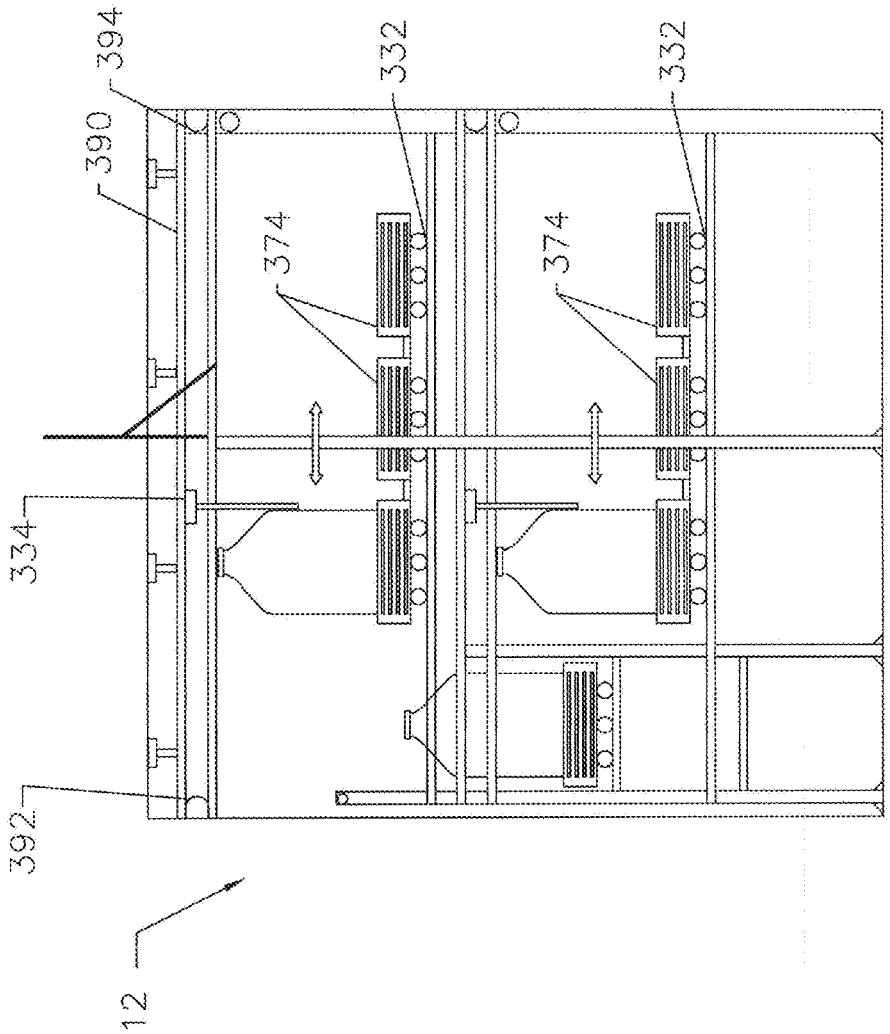
FIG 11

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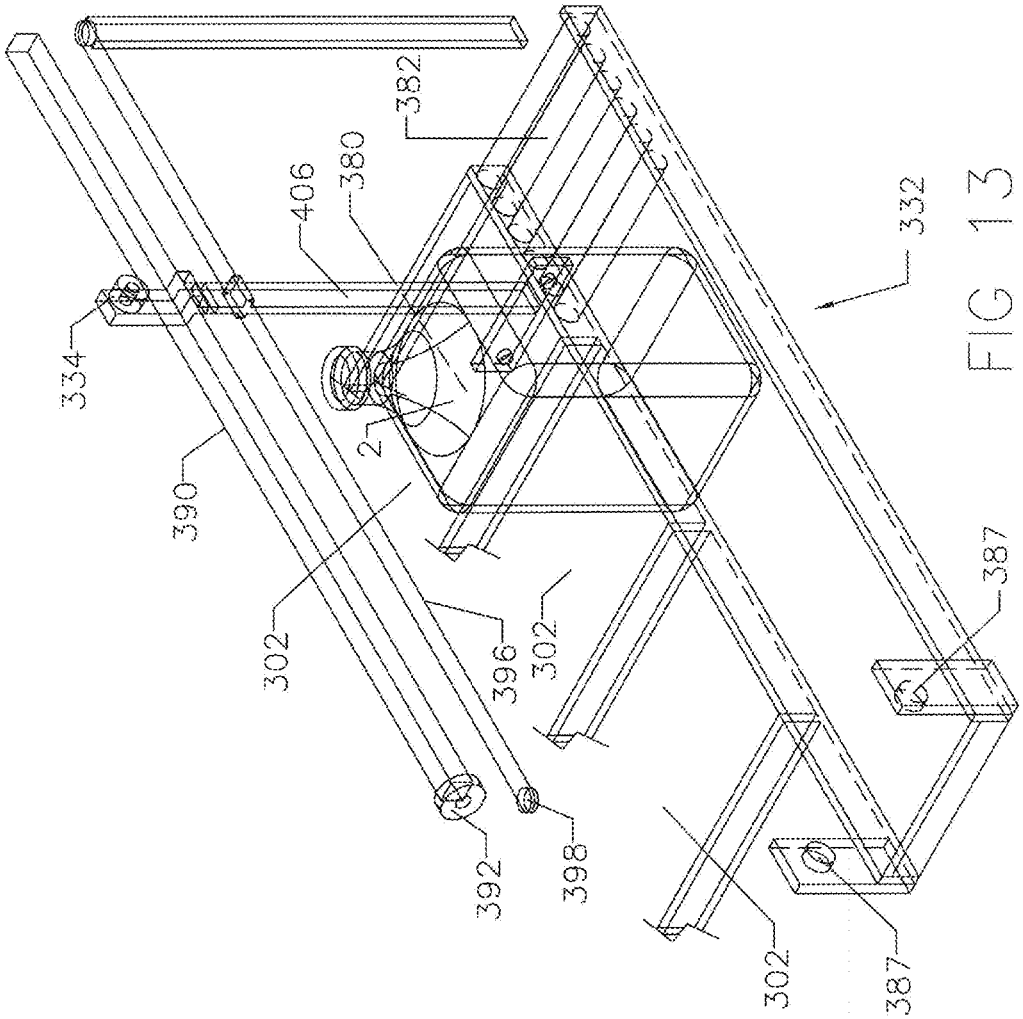


FIG 13

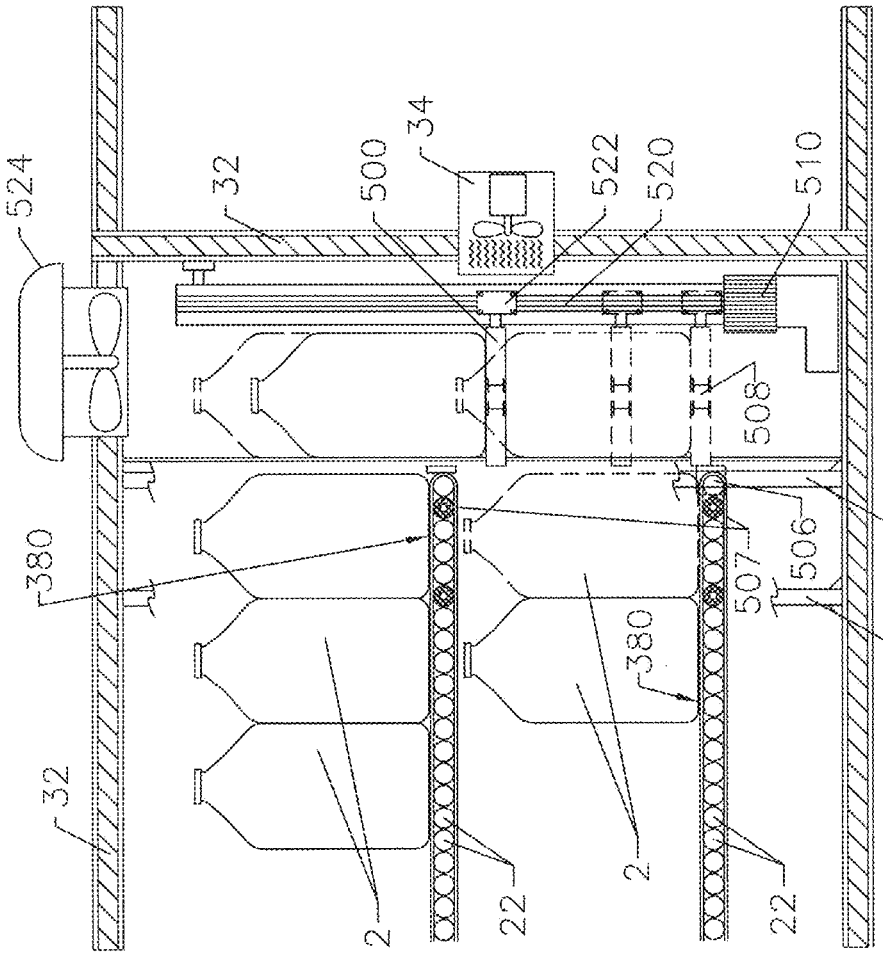


FIG 14

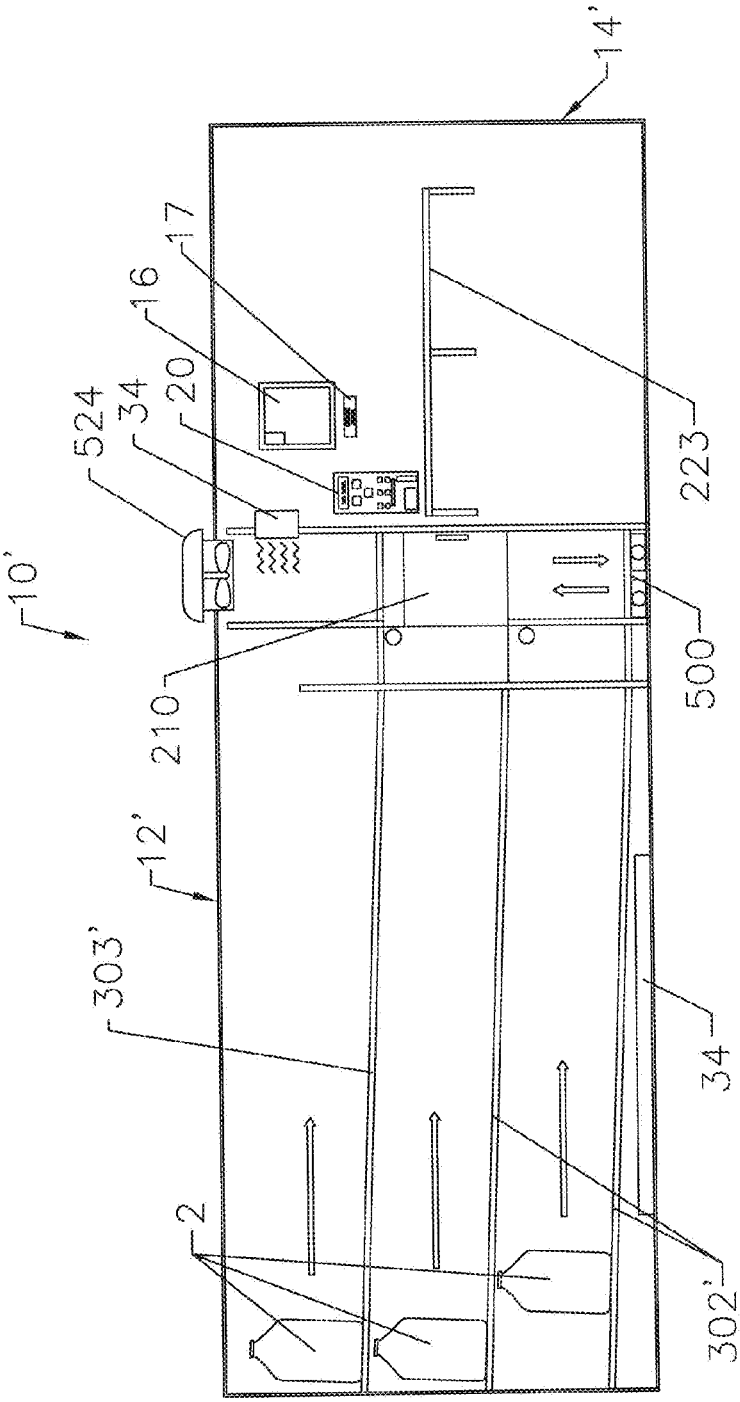


FIG 15

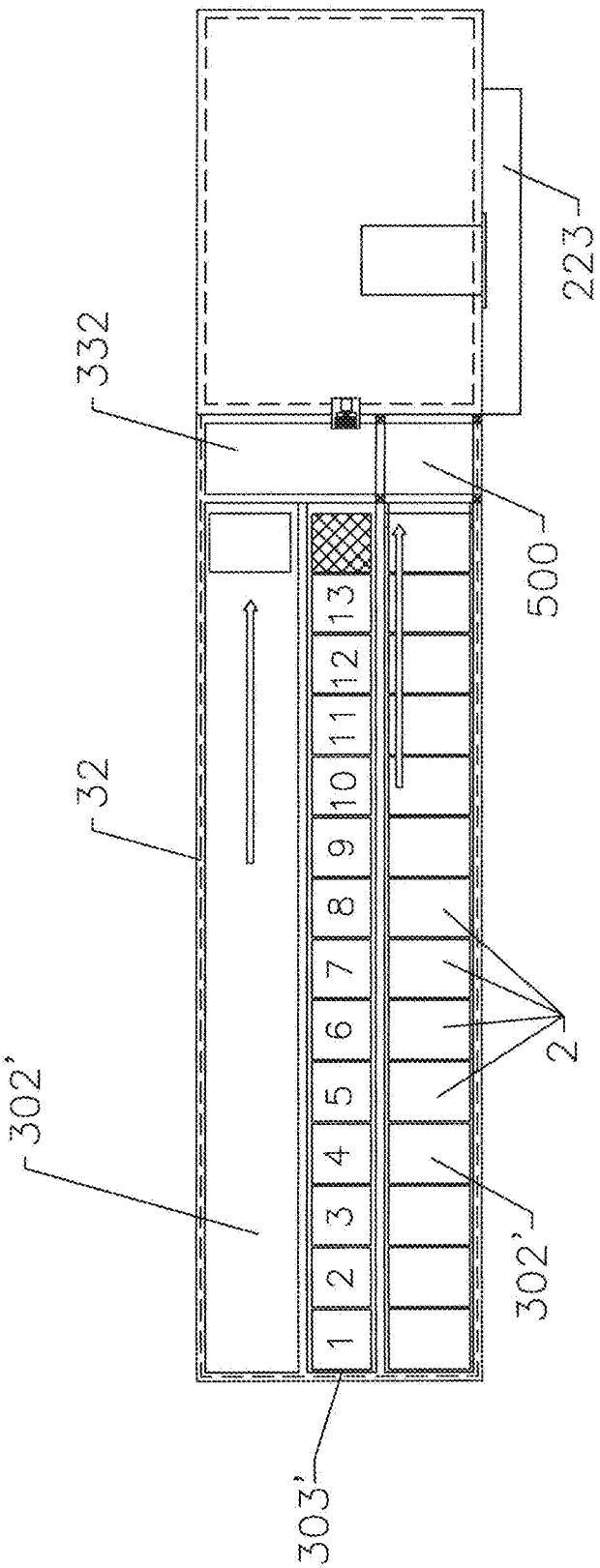


FIG 16

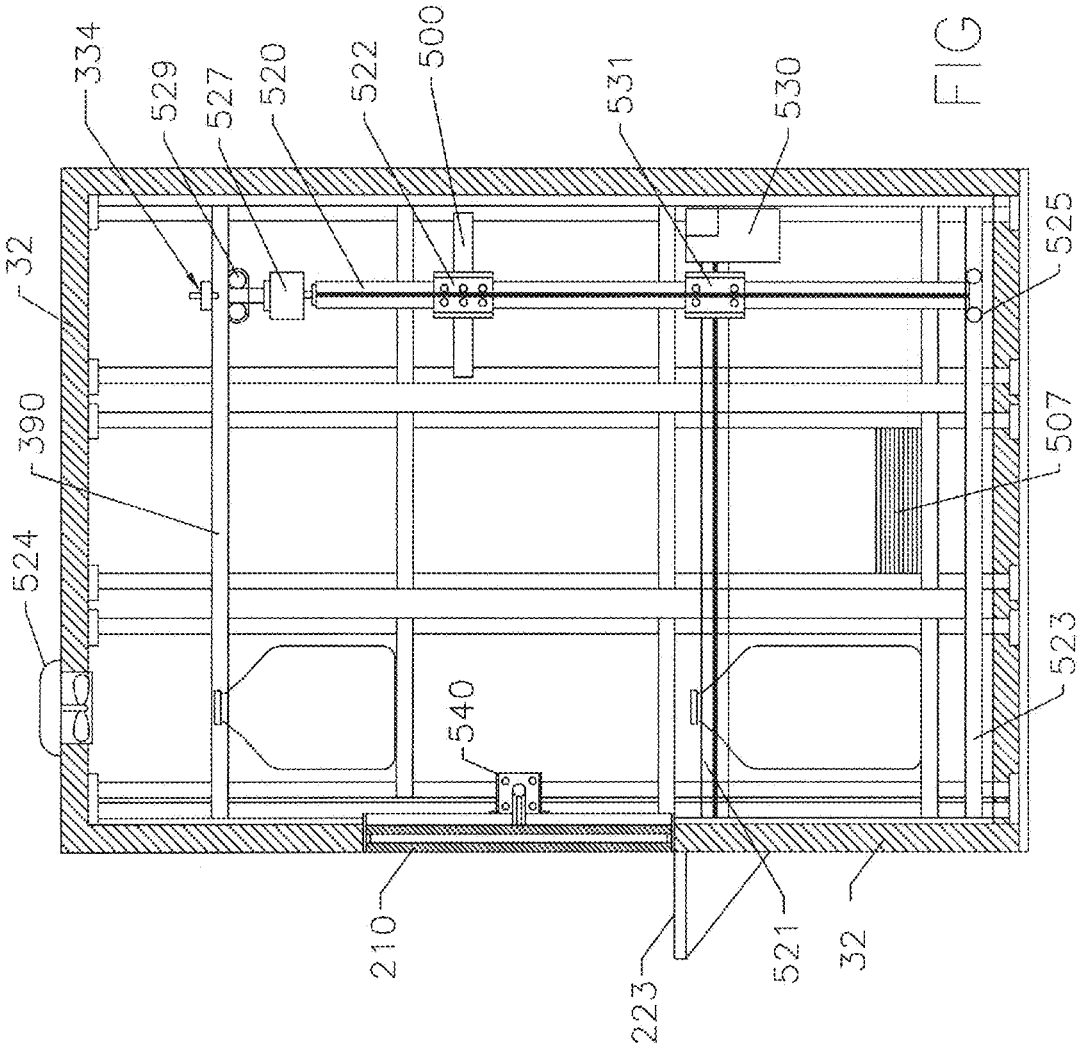
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FIG 17

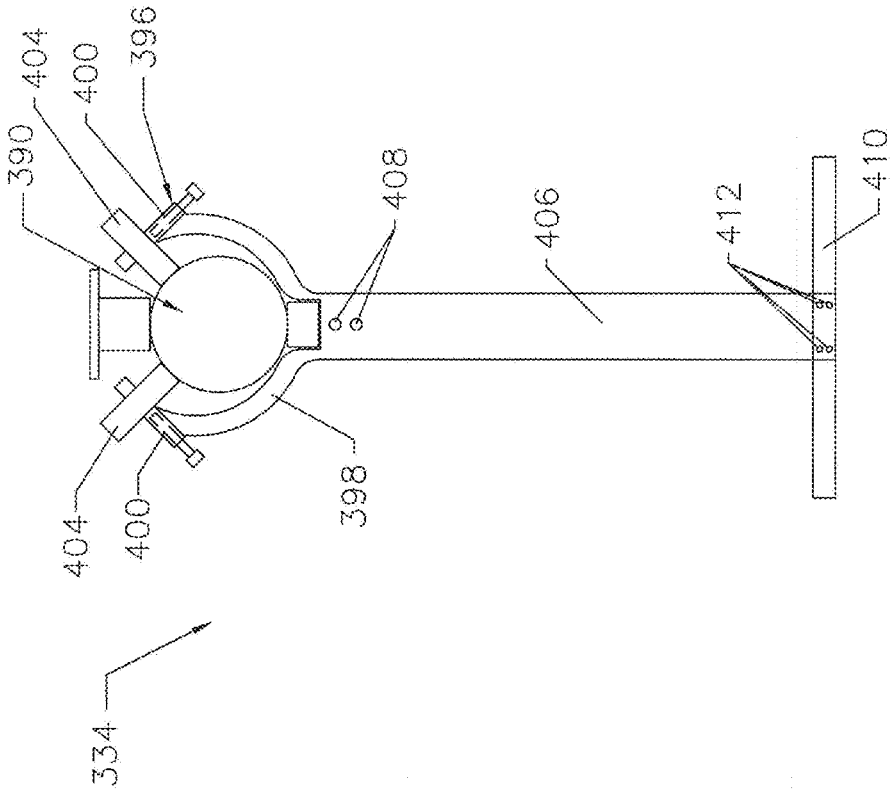



FIG 18

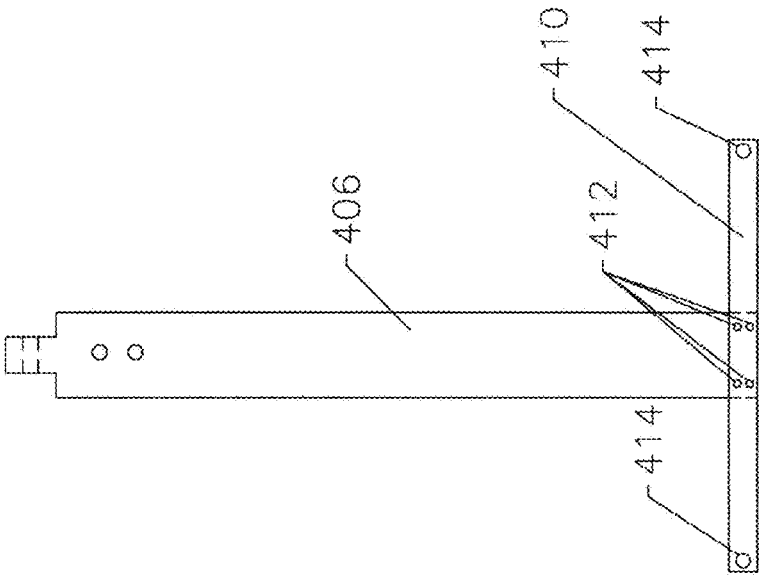
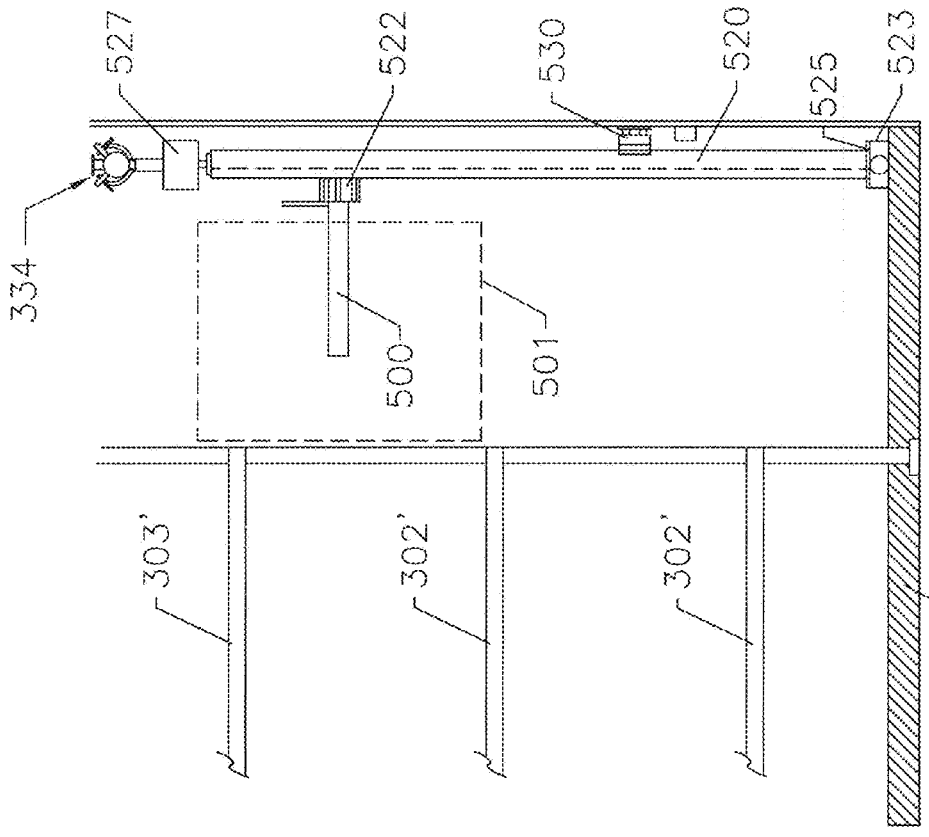



FIG 19

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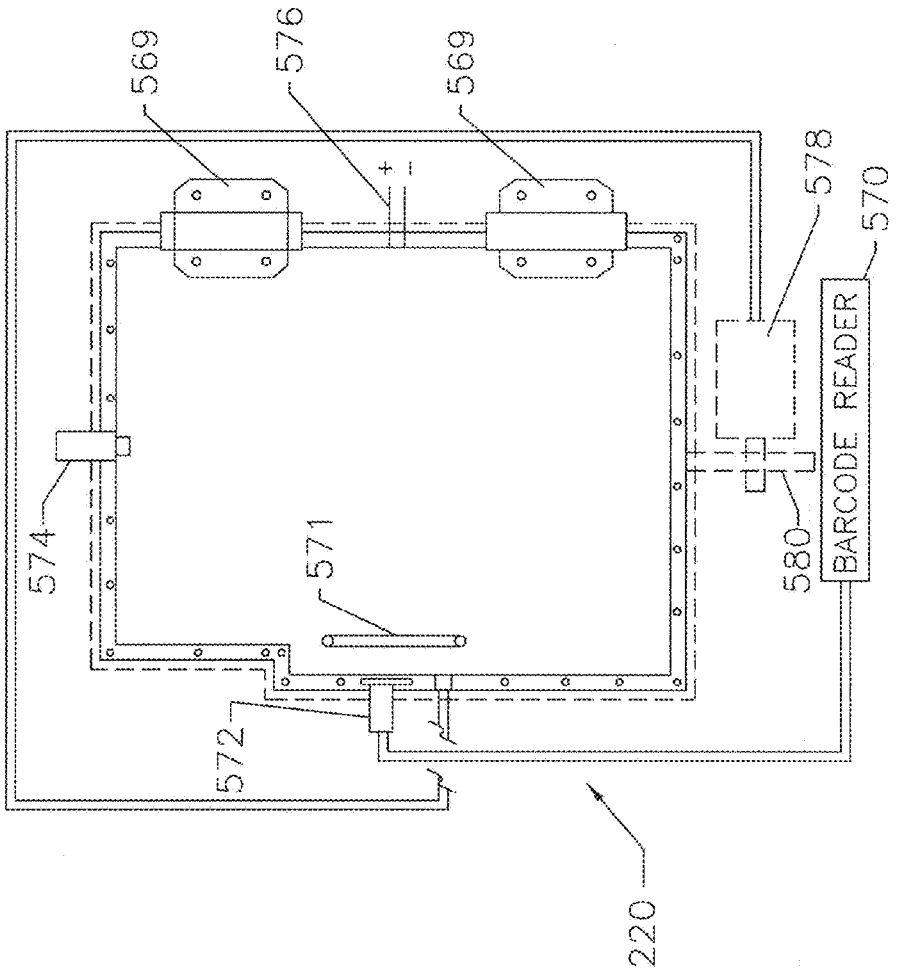



FIG 21

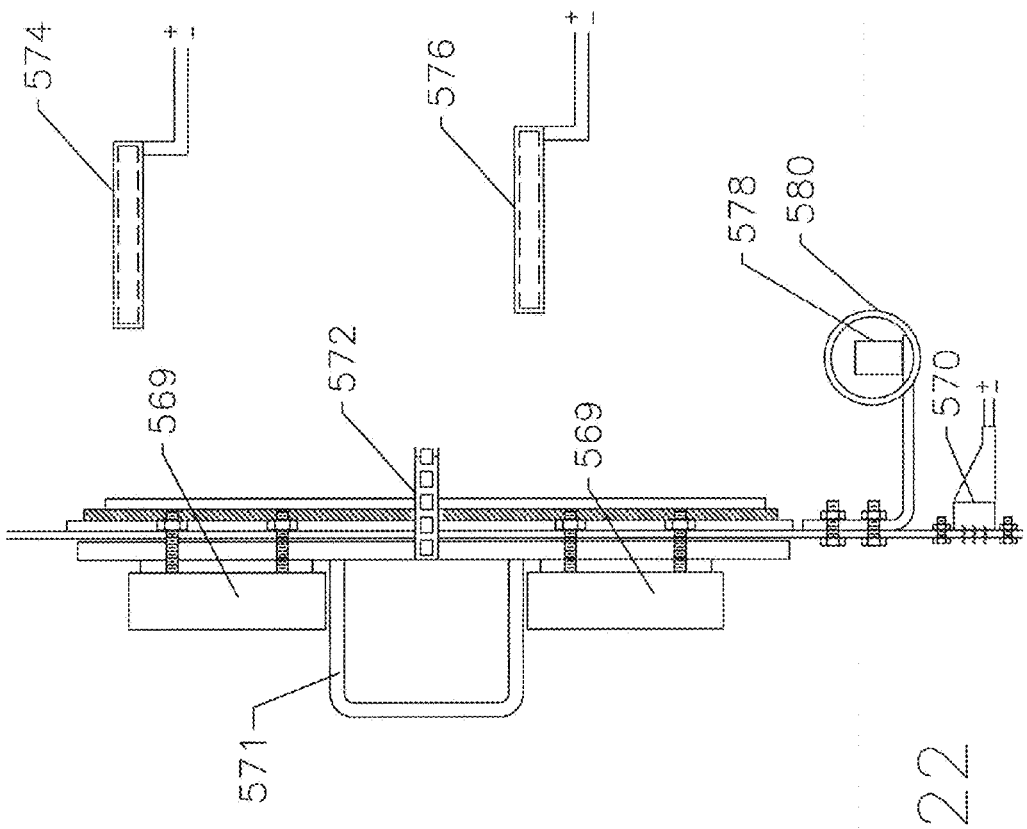



FIG 22

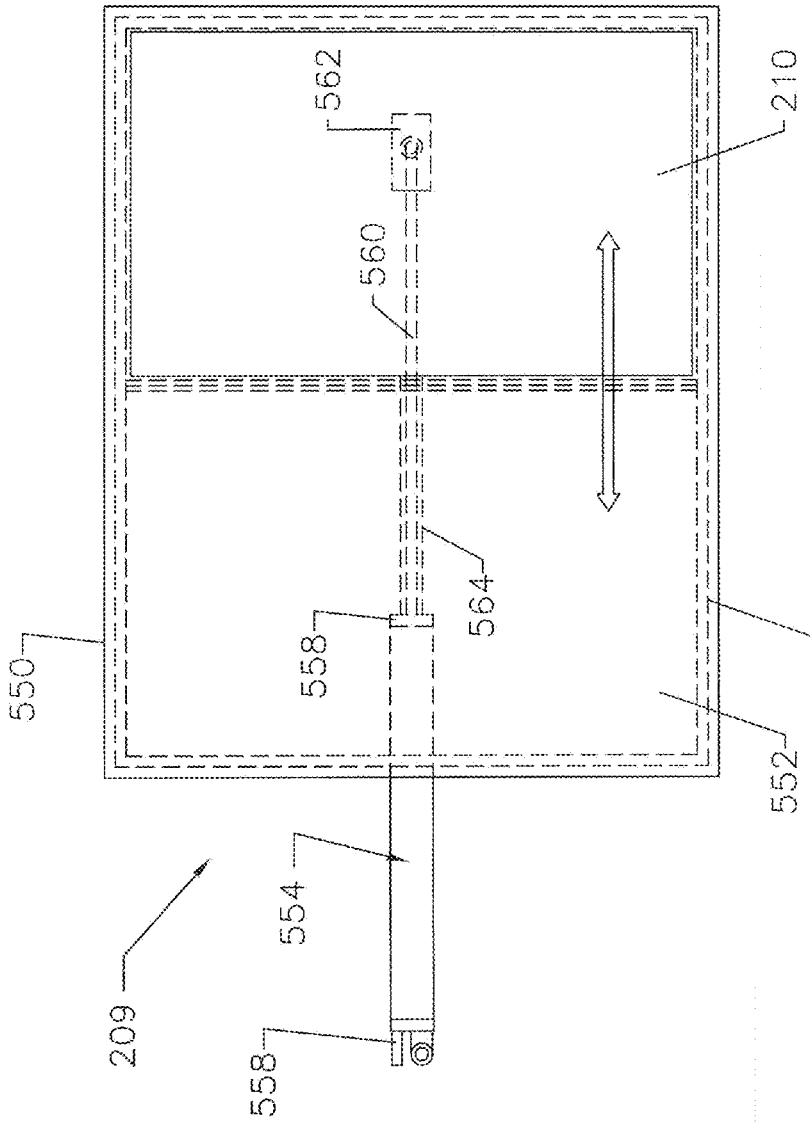



FIG 23

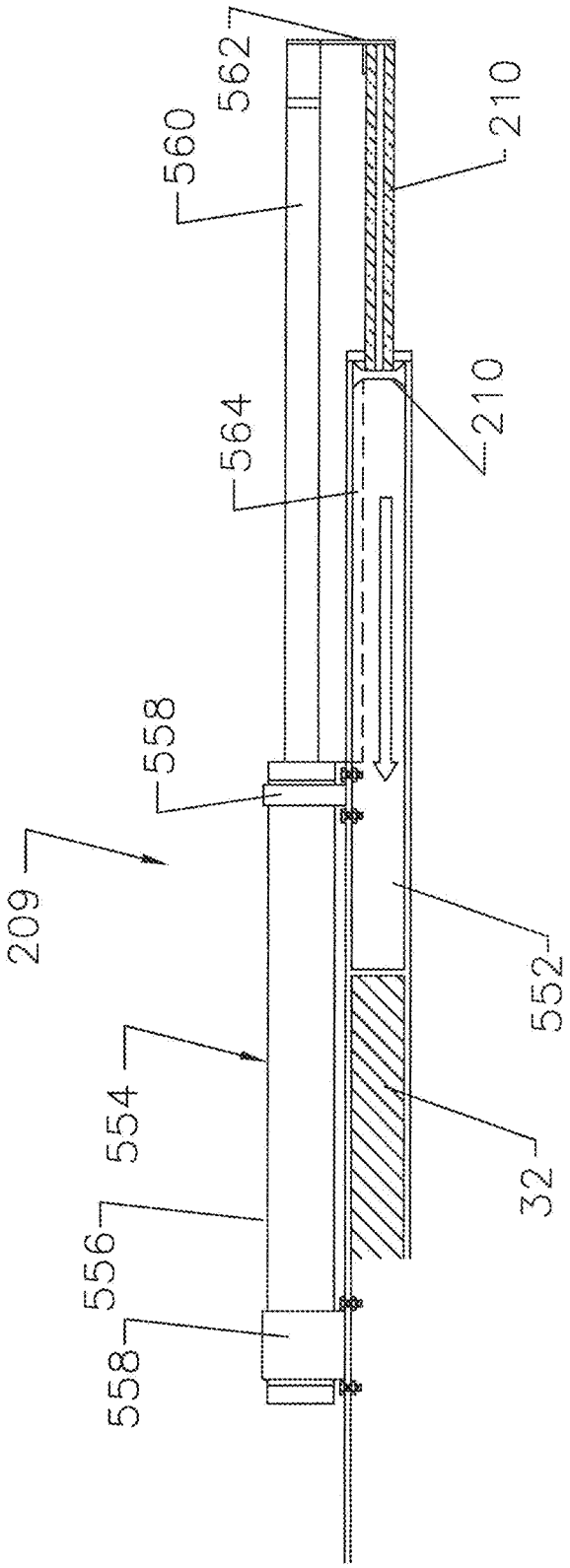



FIG 24

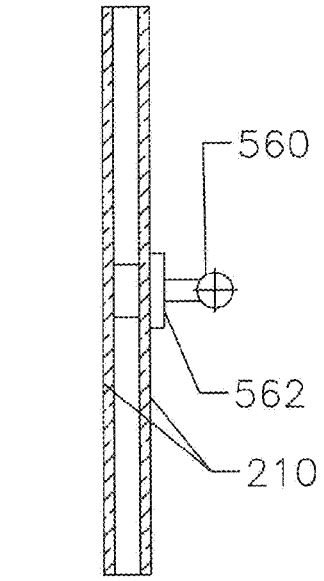
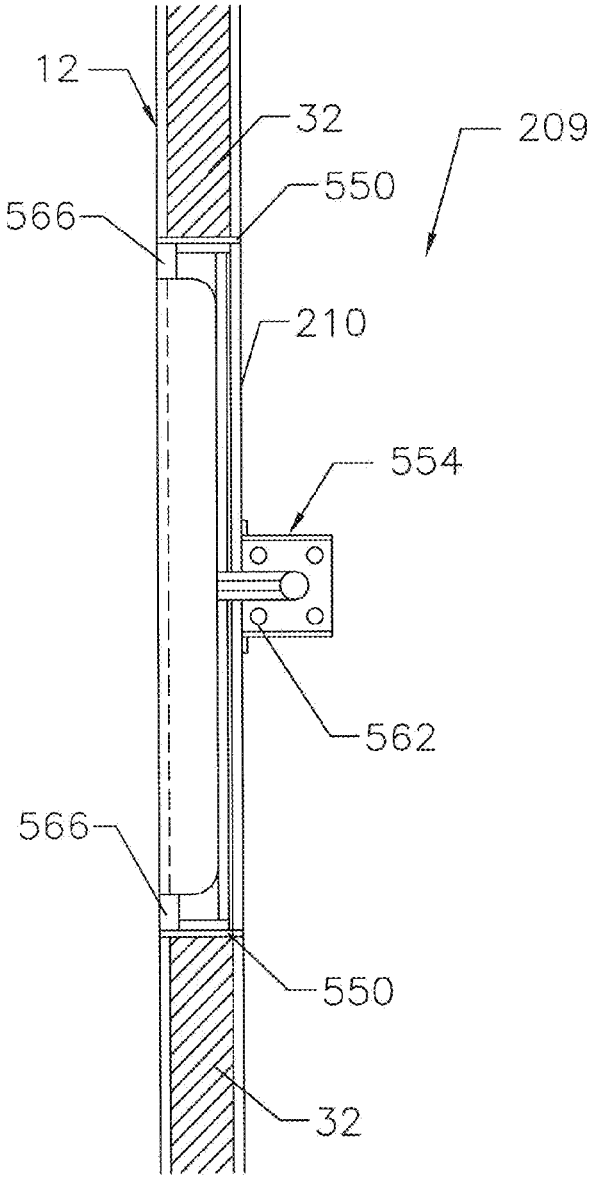



FIG 25A

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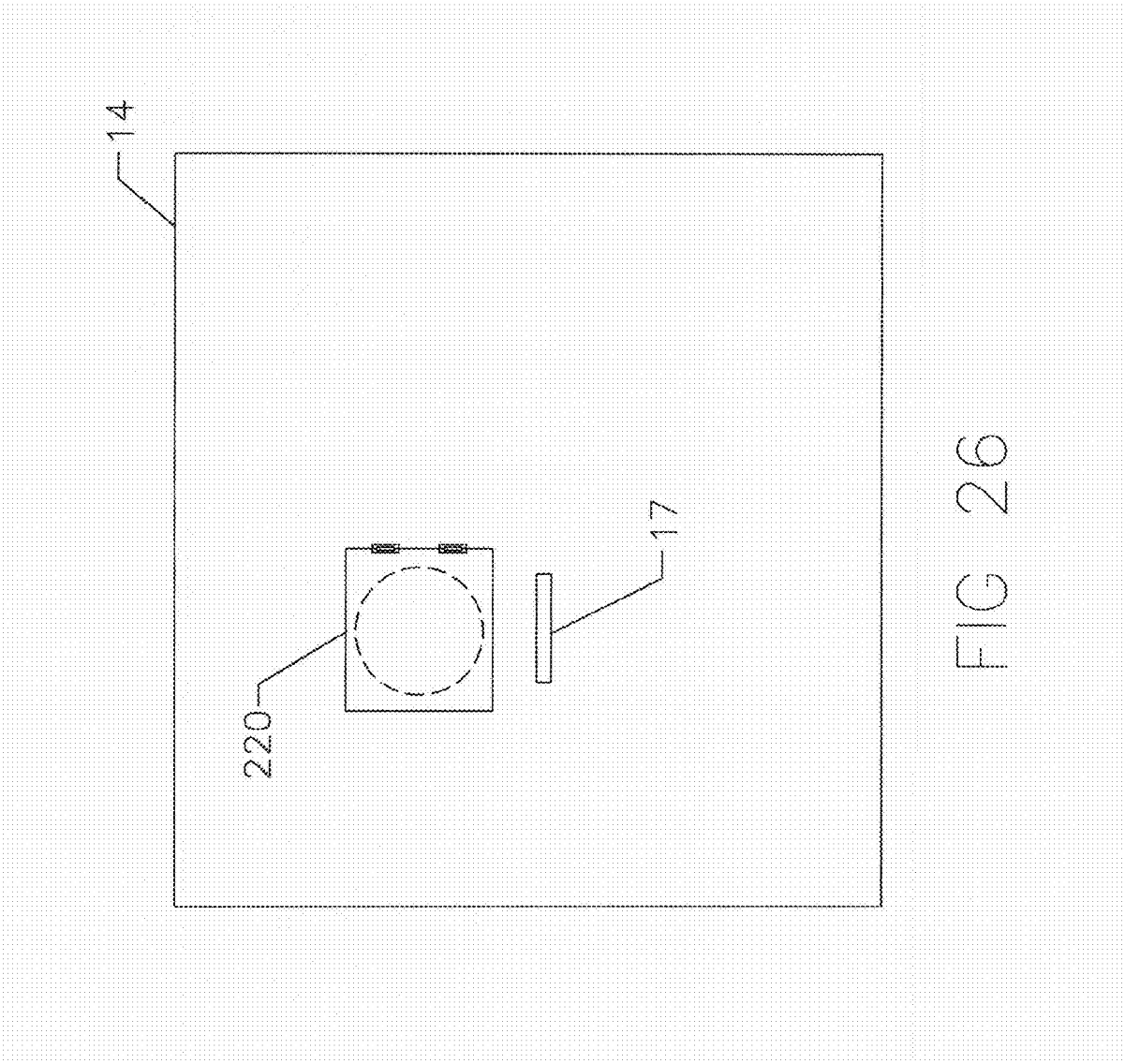
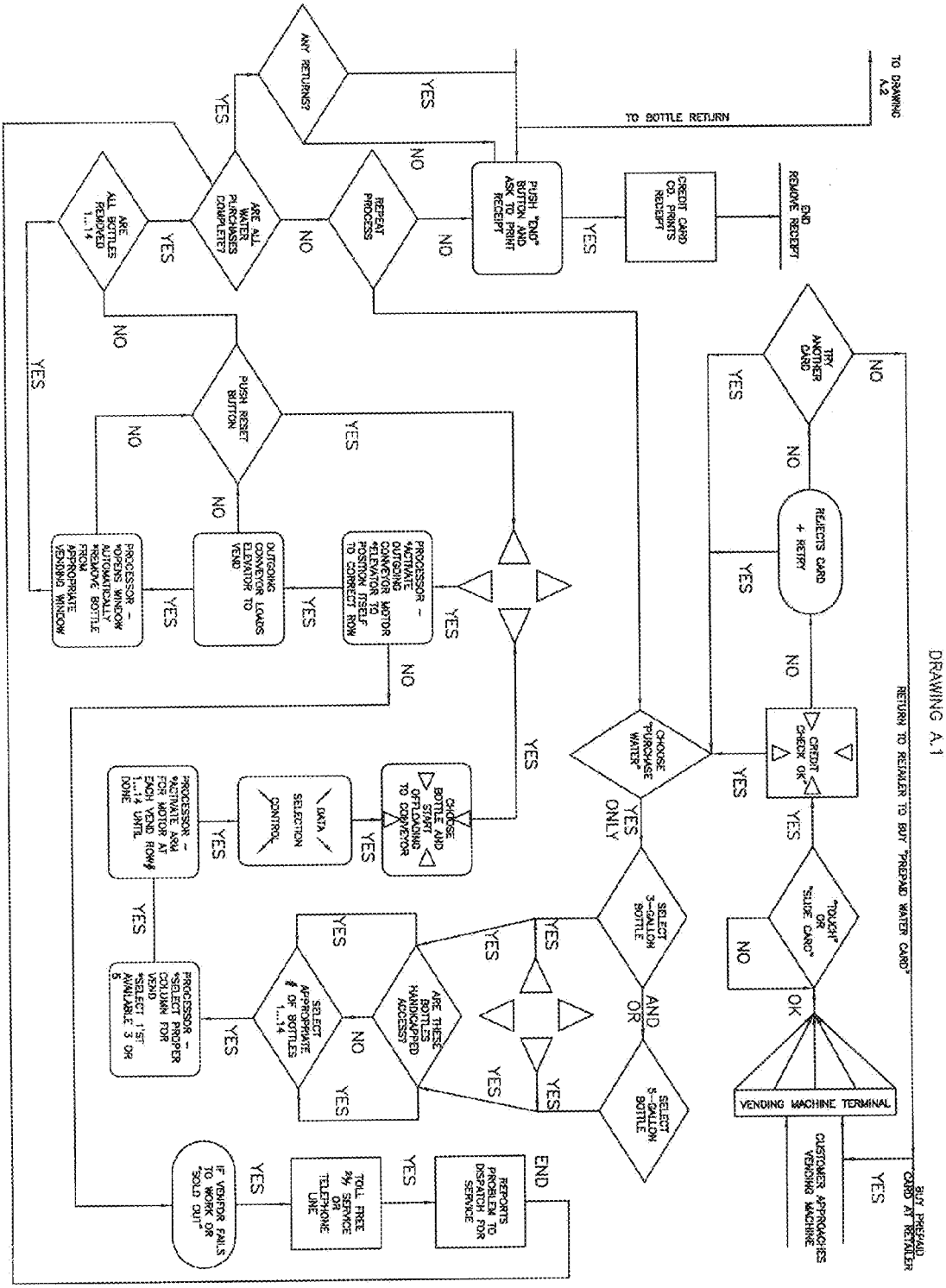



FIG 26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TO BOTTLE RETURN
TO DRAWING A.2
PUSH "END" BUTTON AND ASK TO PRINT RECEIPT
CREDIT CARD CO. PRINTS RECEIPT
END REMOVE RECEIPT
REPEAT PROCESS
ARE ALL WATER PURCHASES COMPLETE?
ALL BOTTLES REMOVED 1...14
PUSH RESET BUTTON
PROCESSOR - *OPENS WINDOW *AUTOMATICALLY *REMOVE BOTTLE FROM APPROPRIATE VENDING WINDOW
OUTGOING CONVEYOR LOADS ELEVATOR TO VEND
PROCESSOR - *ACTIVATE OUTGOING CONVEYOR MOTOR *ELEVATOR TO POSITION ITSELF TO CORRECT ROW
CHOOSE BOTTLE AND START OFFLOADING TO CONVEYOR
DATA SELECTION CONTROL
PROCESSOR - *ACTIVATE ARM FOR MOTOR AT EACH VEND ROW# 1...14 UNTIL DONE
PROCESSOR - *SELECT PROPER COLUMN FOR VEND *SELECT 1'ST, 3 OR 5
SELECT APPROPRIATE # OF BOTTLES 1...14
ARE THESE BOTTLES HANDICAPPED ACCESS?
SELECT 3-GALLON BOTTLE
SELECT 5-GALLON BOTTLE
AND OR
CHOOSE "PURCHASE WATER"
ONLY
TRY ANOTHER CARD
REJECTS CARD + RETRY
CREDIT CHECK OK
"TOUCH" OR "SLIDE CARD"
OK
VENDING MACHINE TERMINAL
CUSTOMER APPROACHES VENDING MACHINE
BUY PREPAID CARD AT RETAILER
RETURN TO RETAILER TO BUY "PREPAID WATER CARD"
IF VENDOR FAILS TO WORK OR "SOLD OUT"
TOLL FREE 1% SERVICE OR TELEPHONE LINE
REPORTS PROBLEM TO DISPATCH FOR SERVICE
END
DRAWING A.1

FIG 27A

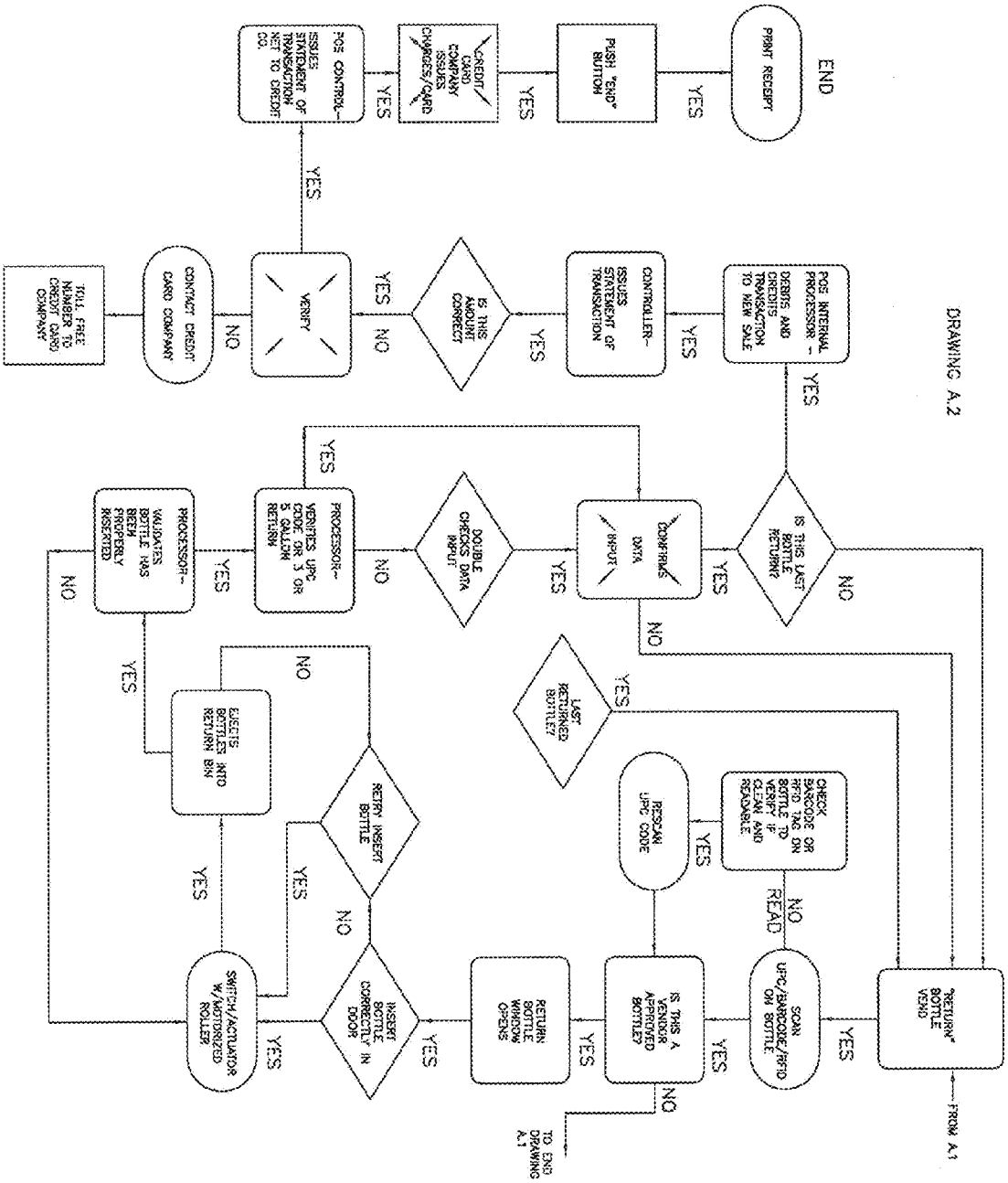

DRAWING A.2
POS INTERNAL PROCESSOR - DEBITS AND CREDITS TRANSACTION TO NEW SALE
CONTROLLER - ISSUES STATEMENT OF TRANSACTION
IS THIS AMOUNT CORRECT
VERIFY
CONTACT CREDIT CARD COMPANY
TOLL FREE NUMBER TO CREDIT CARD COMPANY
POS CONTROL - ISSUES STATEMENT OF TRANSACTION NET TO CREDIT CO.
CREDIT CARD COMPANY ISSUES CHARGES/CARR
PUSH "END" BUTTON
PRINT RECEIPT
END
IS THIS LAST BOTTLE RETURN?
COMPARES DATA INPUT
DOUBLE CHECKS DATA INPUT
PROCESSOR - VERIFIES UPC CODE OR 5 GALLON RETURN
PROCESSOR - VALIDATES BOTTLE HAS BEEN PROPERLY INSERTED
EJECTS BOTTLES INTO RETURN BIN
LAST RETURNED BOTTLE?
RETRY INSERT BOTTLE
INSERT BOTTLE CORRECTLY IN DOOR
SWITCH/ACTUATOR W/MOTORIZED ROLLER
RETURN BOTTLE WINDOW OPENS
IS THIS A VENDOR APPROVED BOTTLE?
RESCAN UPC CODE
CHECK BARCODE OR RFID TAG ON BOTTLE TO VERIFY IF CLEAN AND READABLE
SCAN UPC/BARCODE/RFID ON BOTTLE
"RETURN" BOTTLE VEND
FROM A.1
TO END DRAWING A.1
YES
NO
READ

FIG 27B

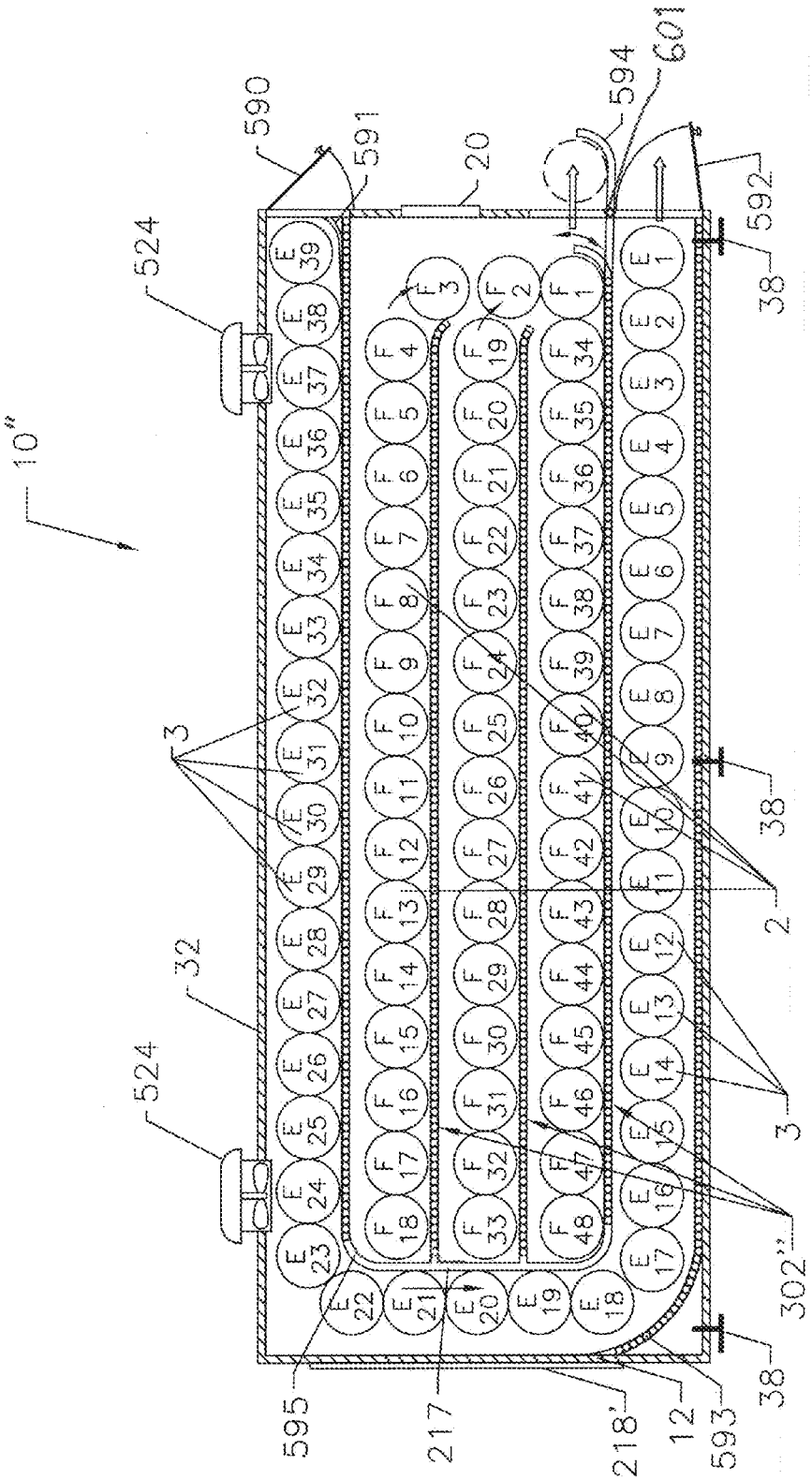

10''
524
590
591
20
594
601
592
38
524
3
32
2
38
524
3
302''
38
595
217
218'
12
593

FIG 28

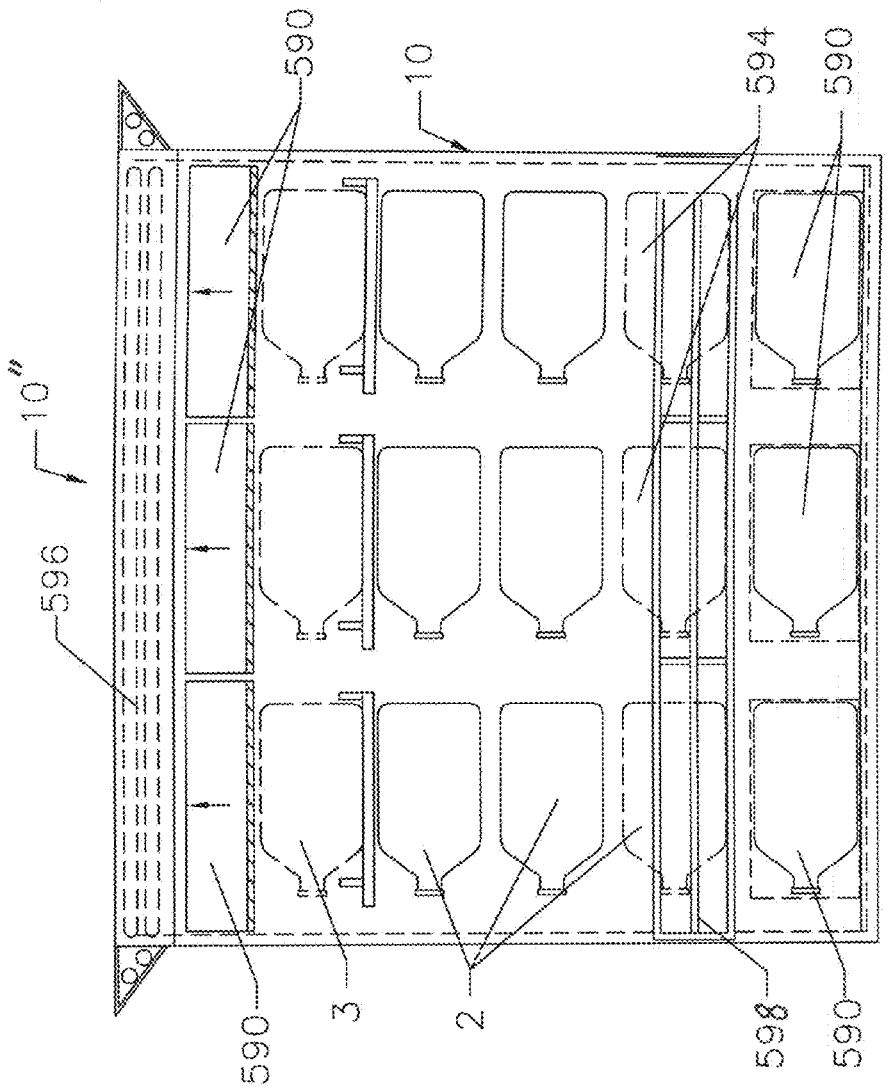



FIG 29

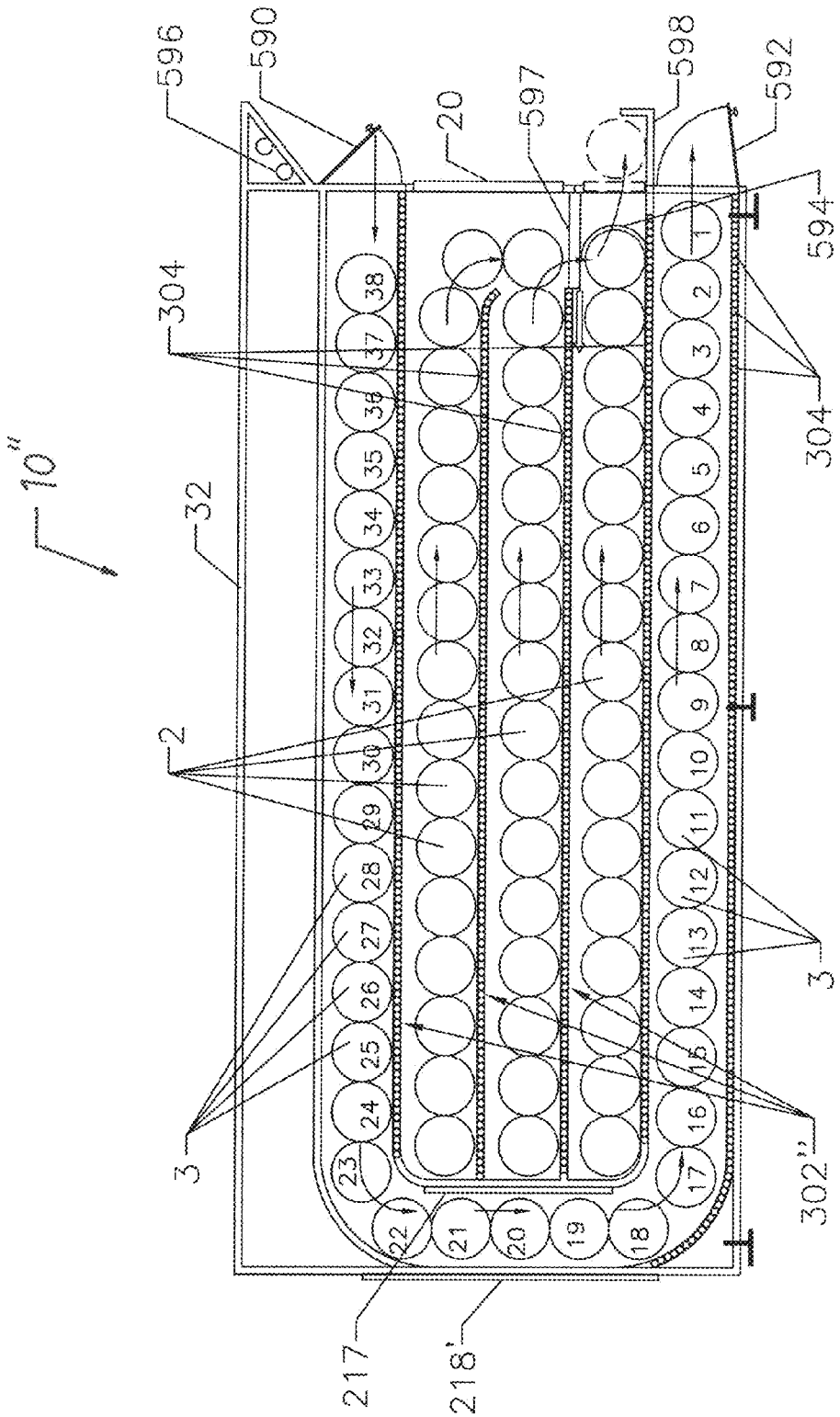



FIG 30

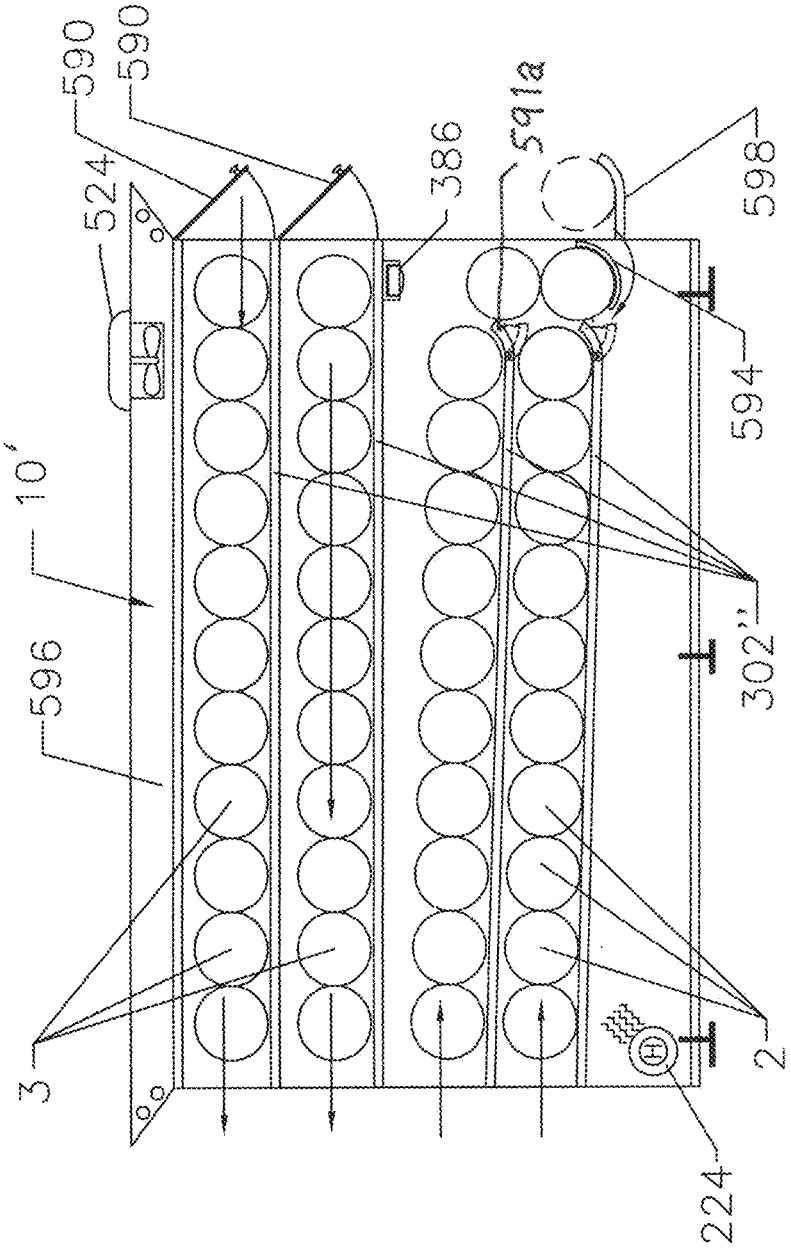



FIG 31

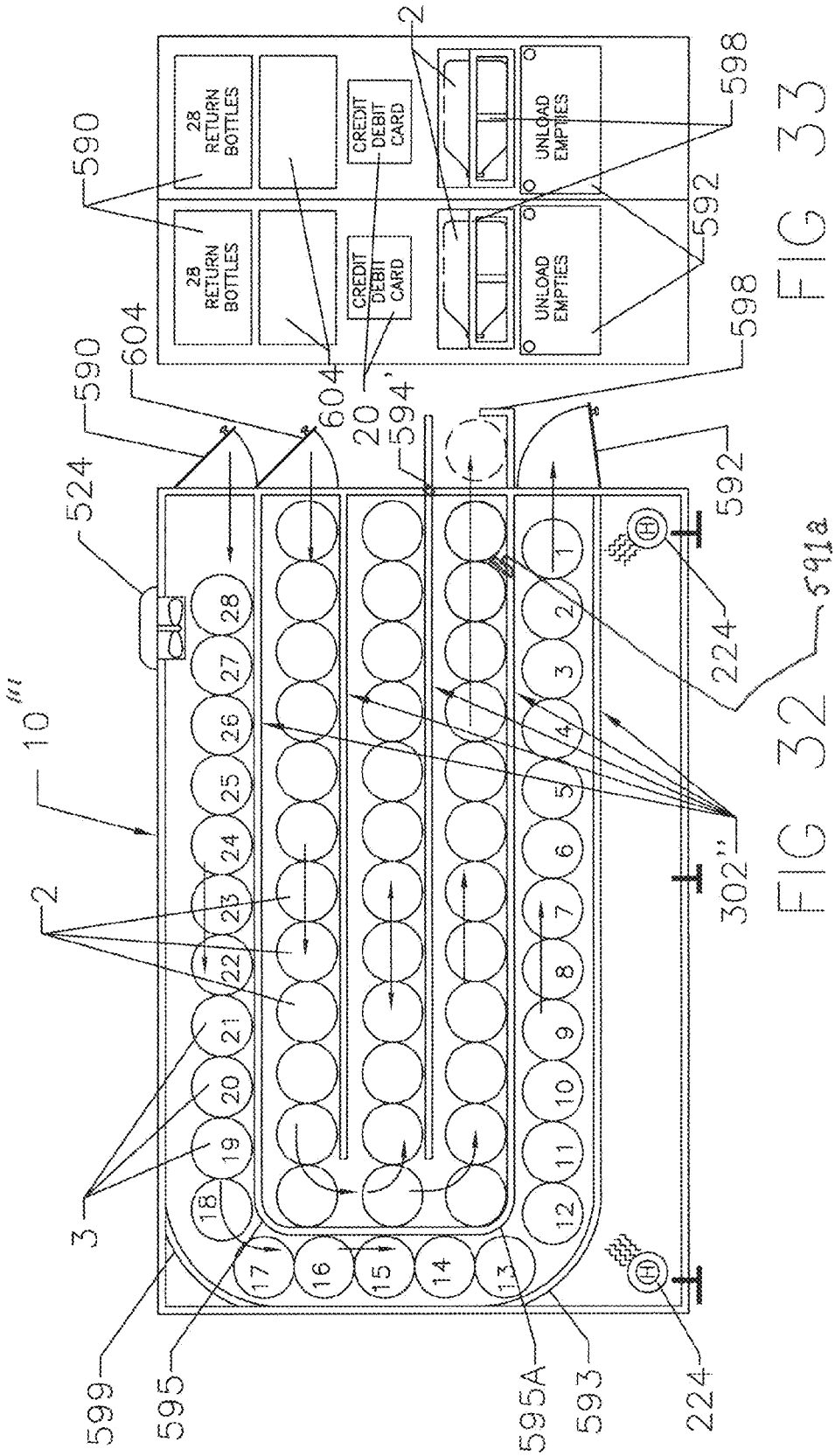

28 RETURN BOTTLES
CREDIT DEBIT CARD
UNLOAD EMPTIES
28 RETURN BOTTLES
CREDIT DEBIT CARD
UNLOAD EMPTIES
2
590
598
592
604
20
594'
524
10"
3
599
595
595A
593
224
591a
302"

FIG 32

FIG 33

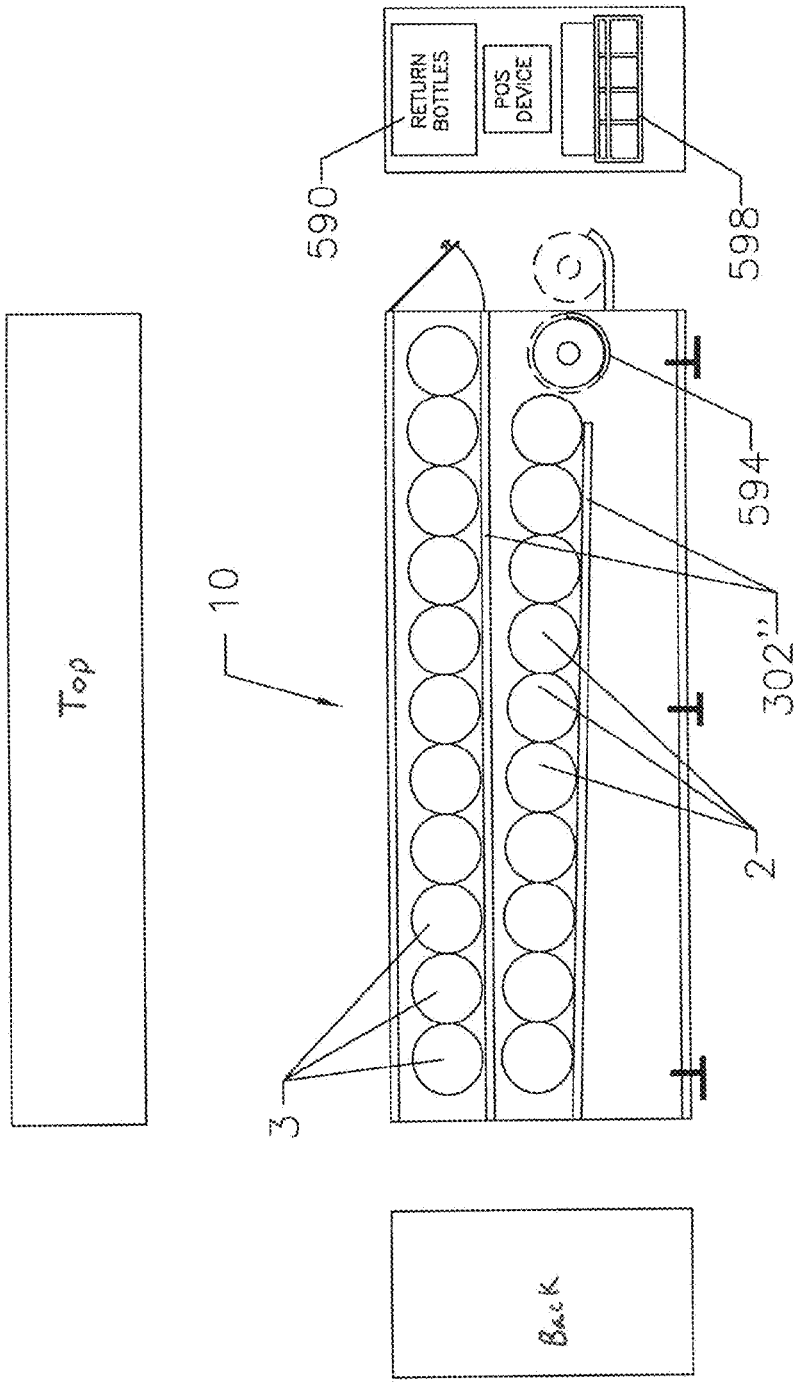



FIG 34

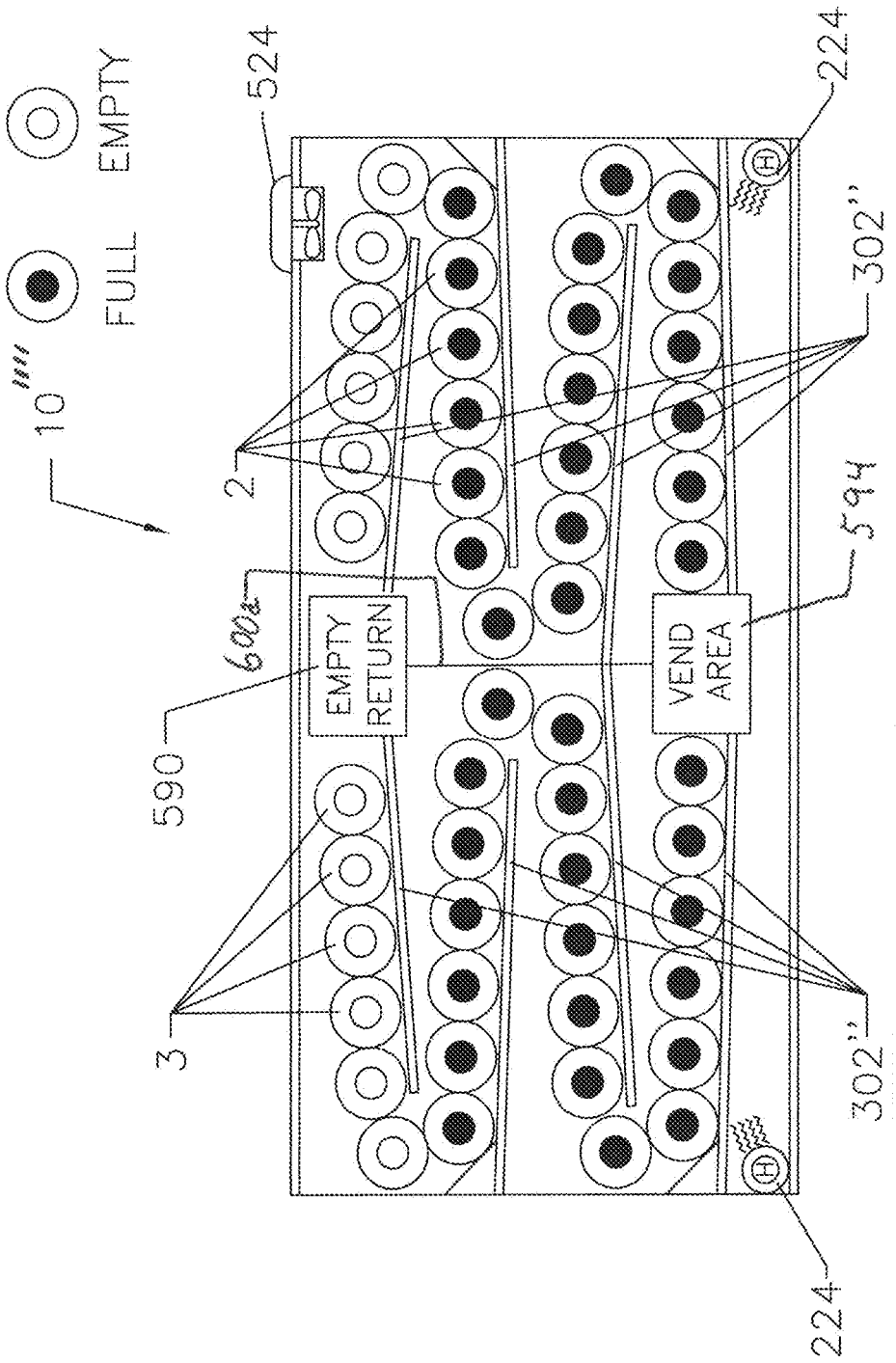

FULL
EMPTY
10''''
524
224
302''
2
594
60a
EMPTY RETURN
VEND AREA
590
3
302''
224

FIG 35

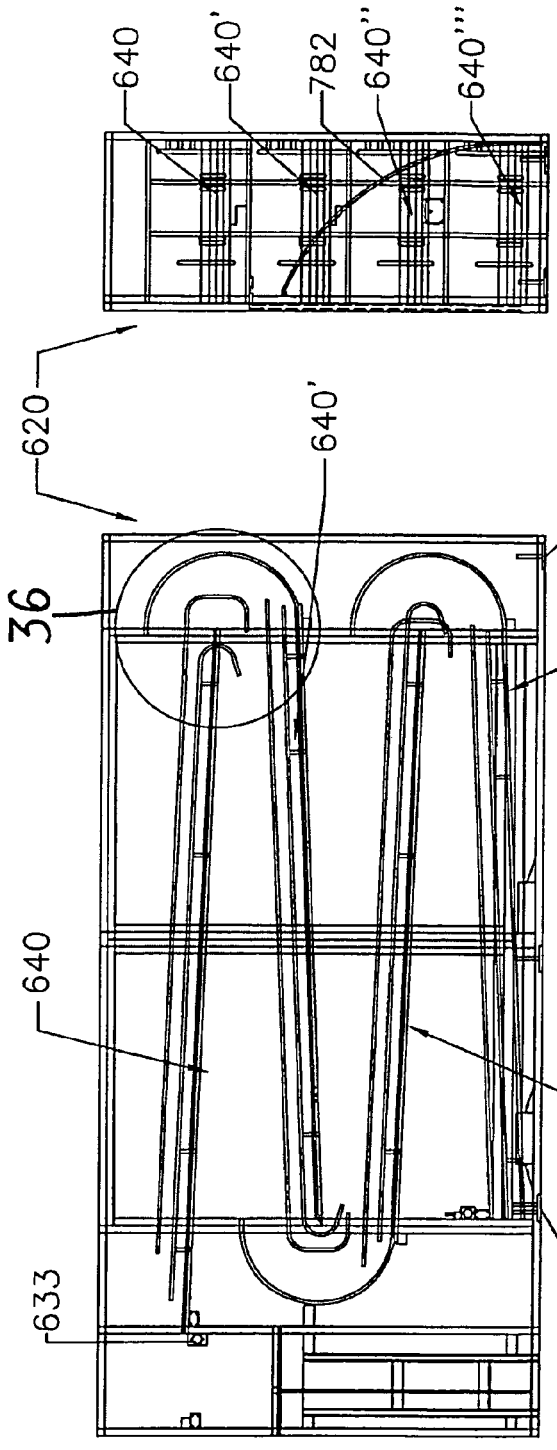



FIG 36

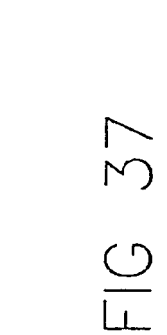



FIG 37

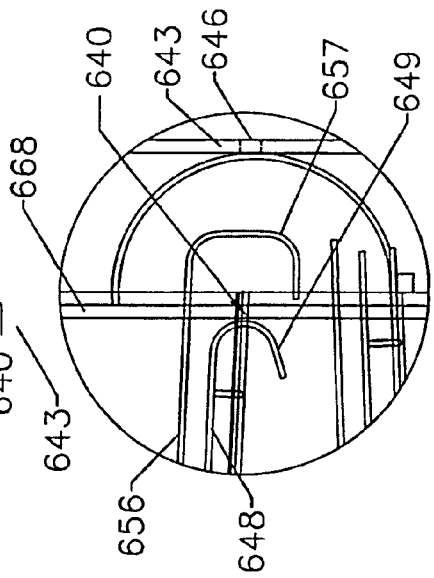



FIG 38

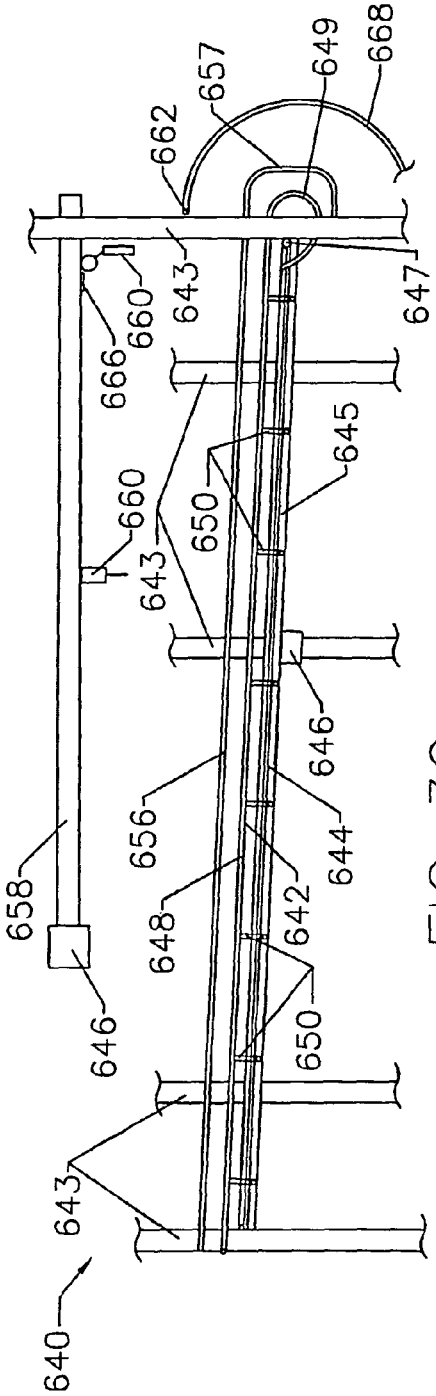



FIG 39

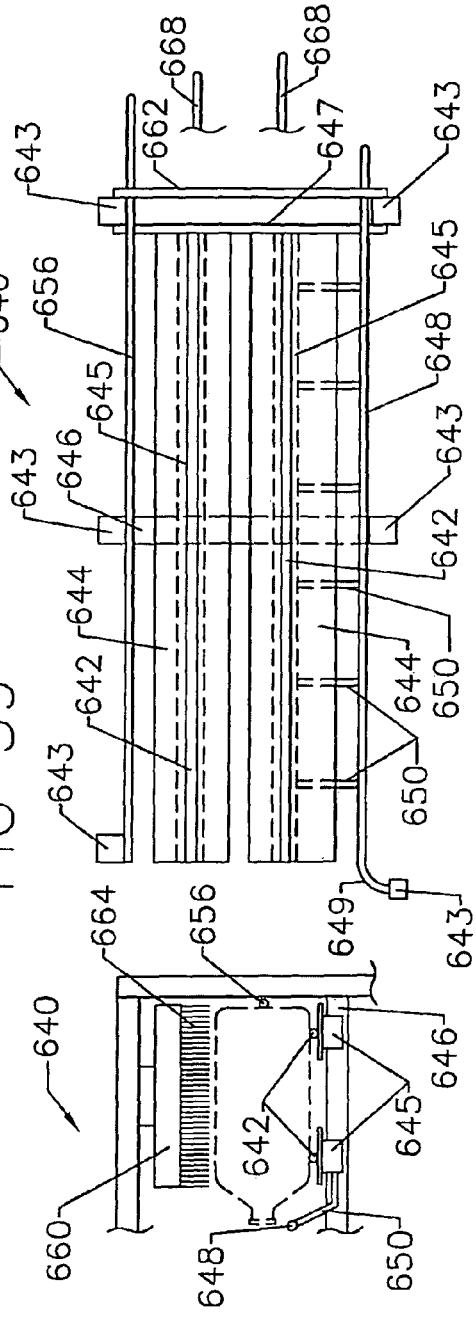



FIG 40




FIG 41

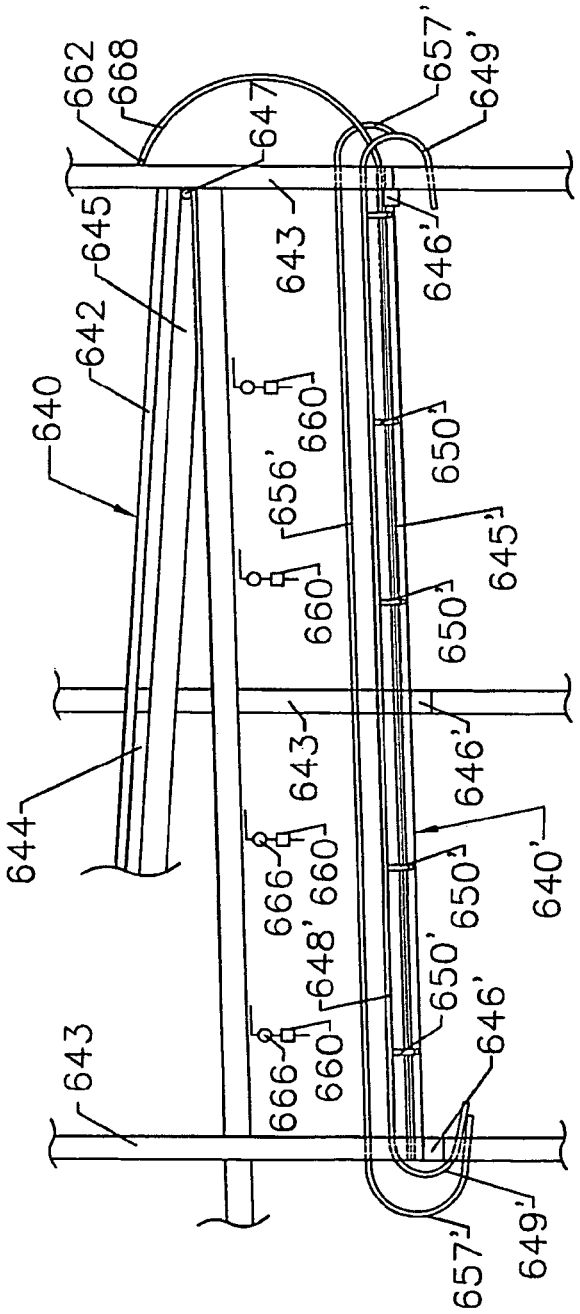

662
668
647
657'
649'
645
643
646'
642
640
660
656'
650'
645'
644
666
648'
650
640'
646
657
649

FIG 42

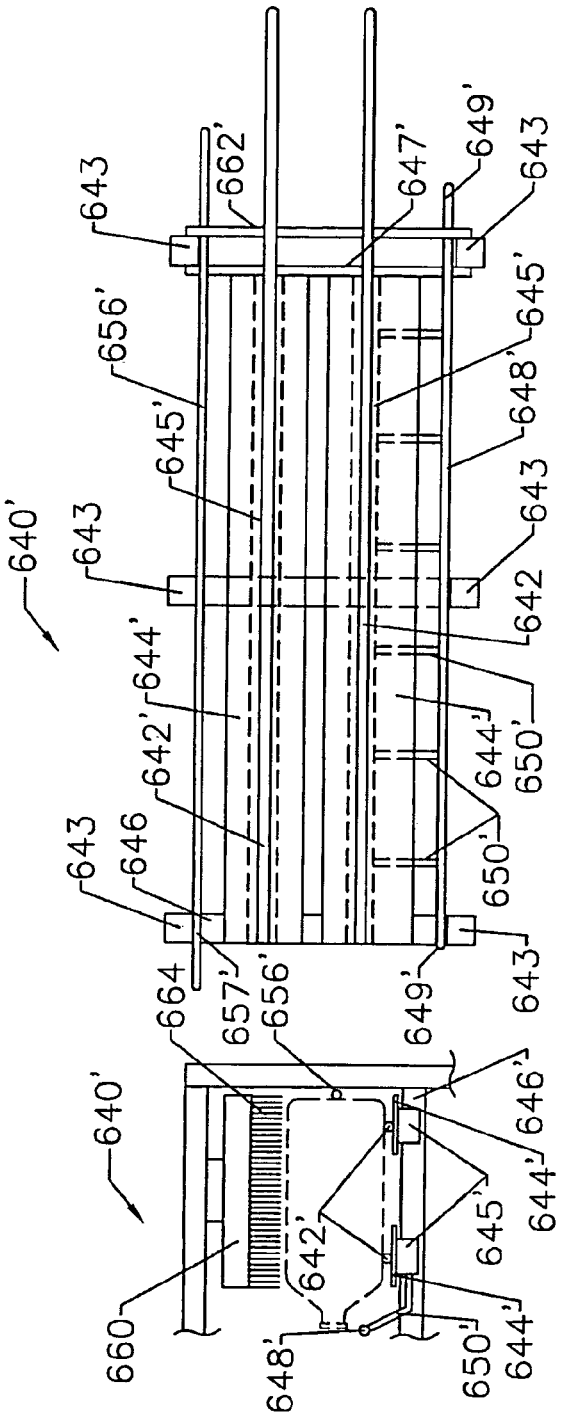

640'
643
662'
647'
649'
643
656'
645'
645'
648'
643
643
642
644'
642'
644'
650'
643
646
650'
664
657'
656'
649'
643
640'
646'
644'
645'
642'
660
648'
650'
644'

FIG 43

FIG 44

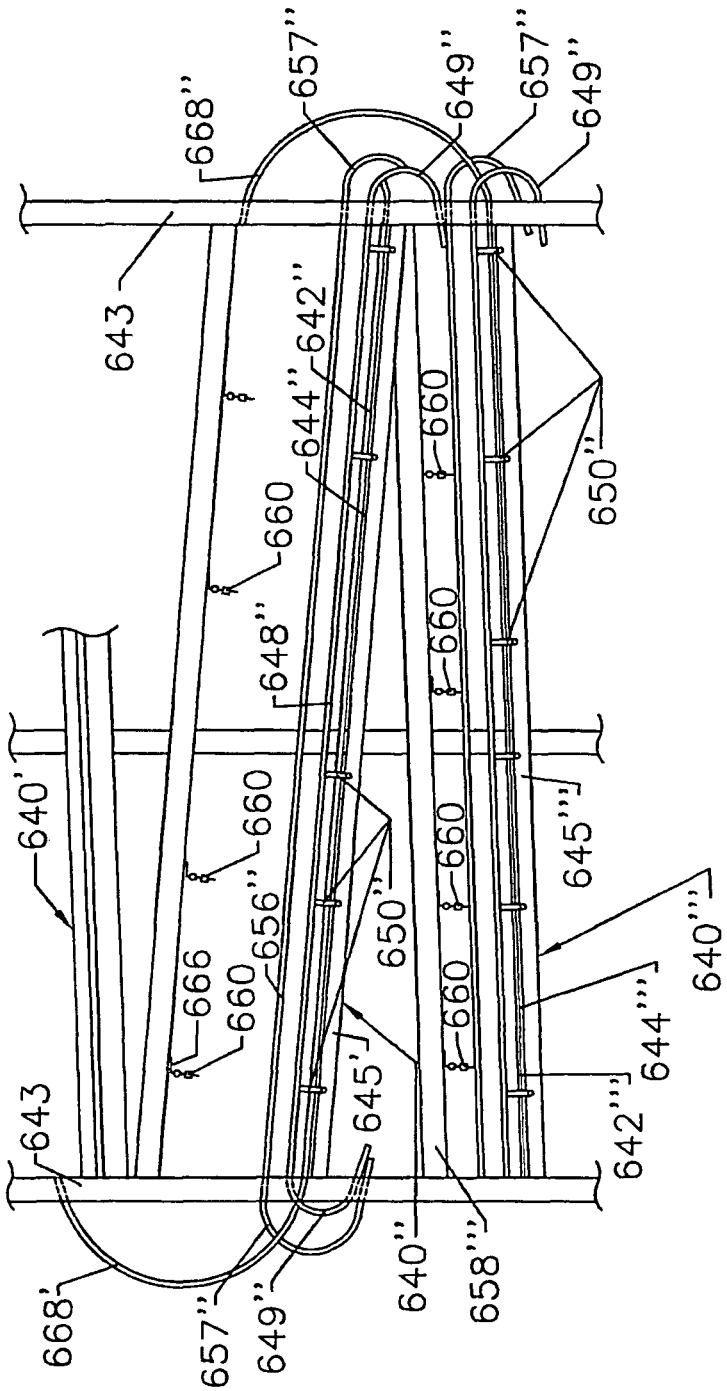

668''
657''
649''
657''
649''
643
642''
644''
660
650''
660
648''
660
640'
660
656''
666
660
650''
660
660
645'''
640'''
644'''
642'''
643
645'
640''
658'''
668'
657''
649''

FIG 45

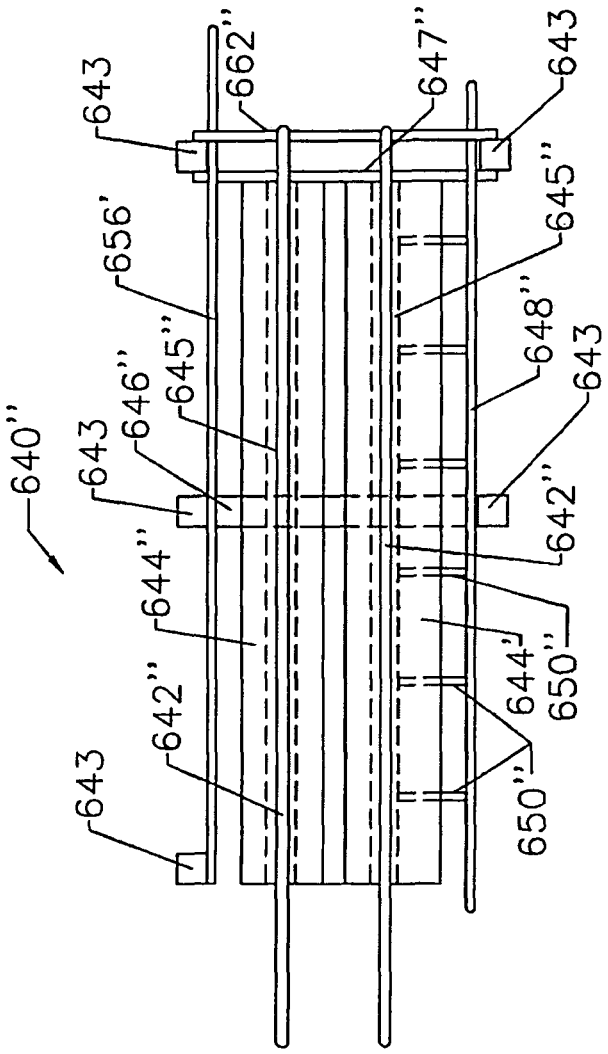

640''
643
642''
644''
646''
645''
656'
662''
647''
643
645''
648''
643
642''
644'
650''
650''
643

FIG 46

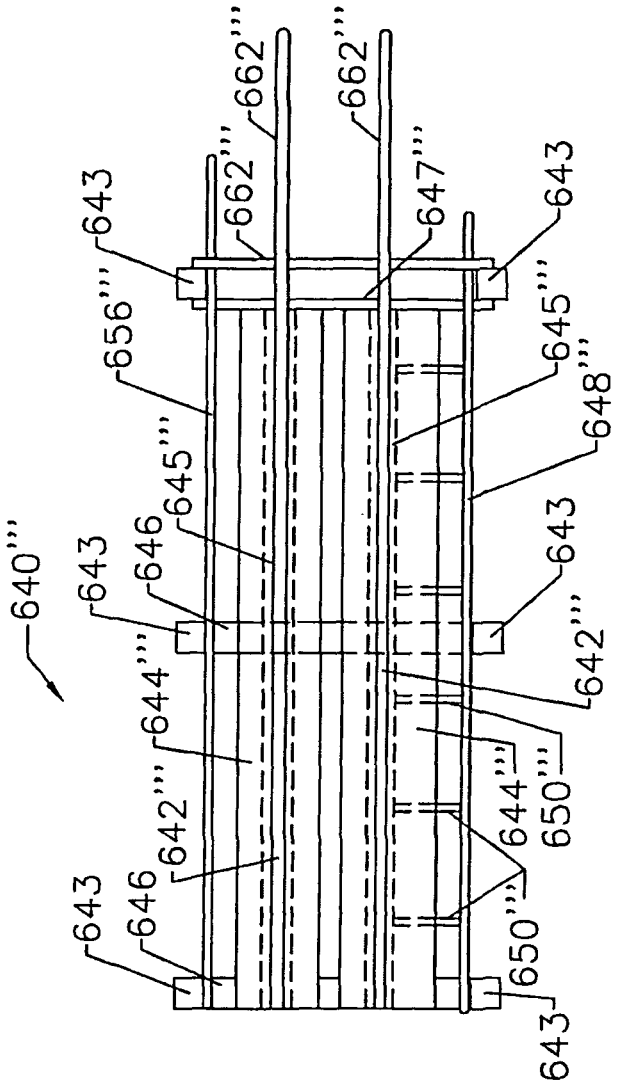

640'''
643
646
644'''
642'''
643
646
645'''
656'''
643
662'''
662'''
662'''
647'''
643
645'''
648'''
643
642'''
644'''
650'''
650'''
643

FIG 47

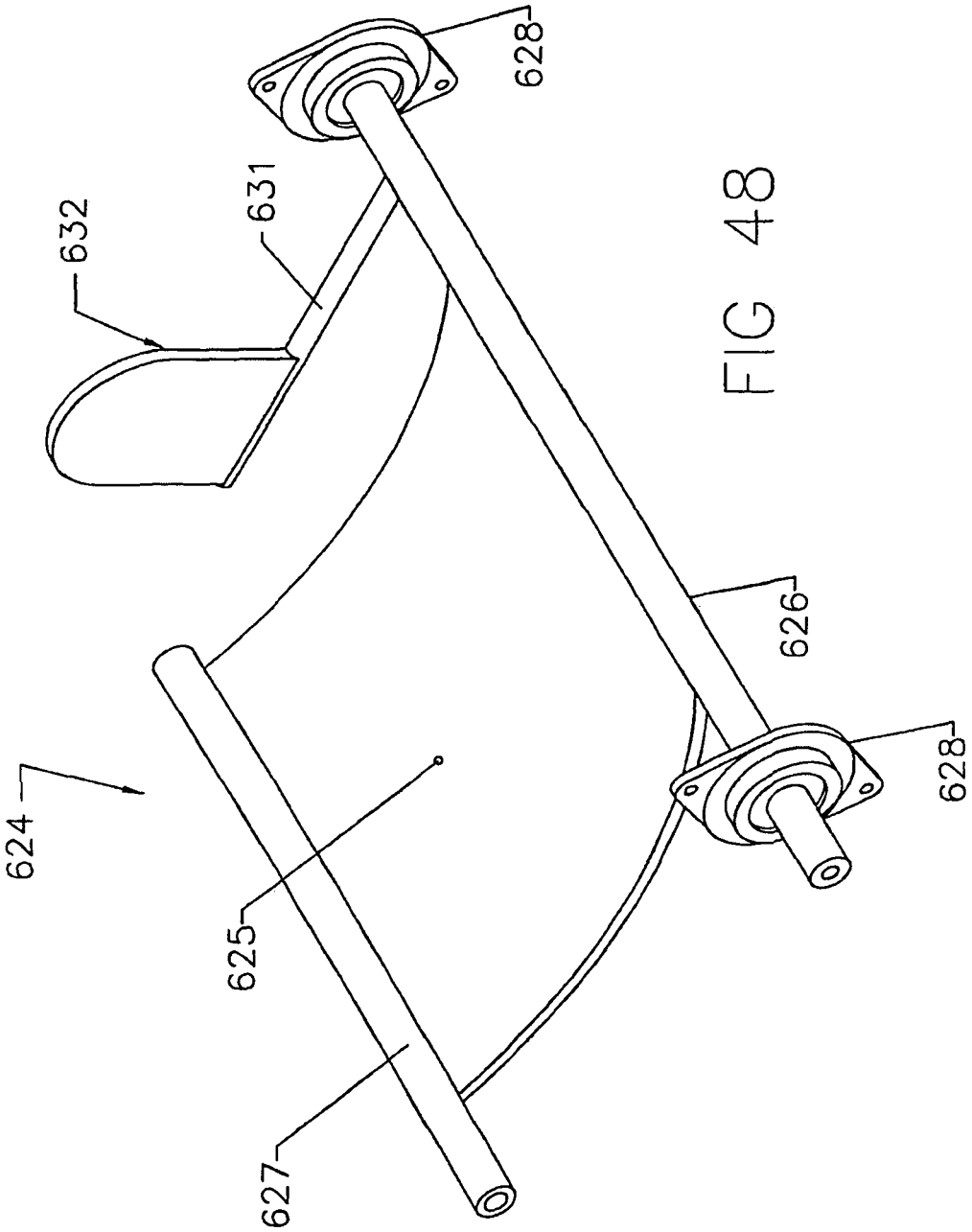
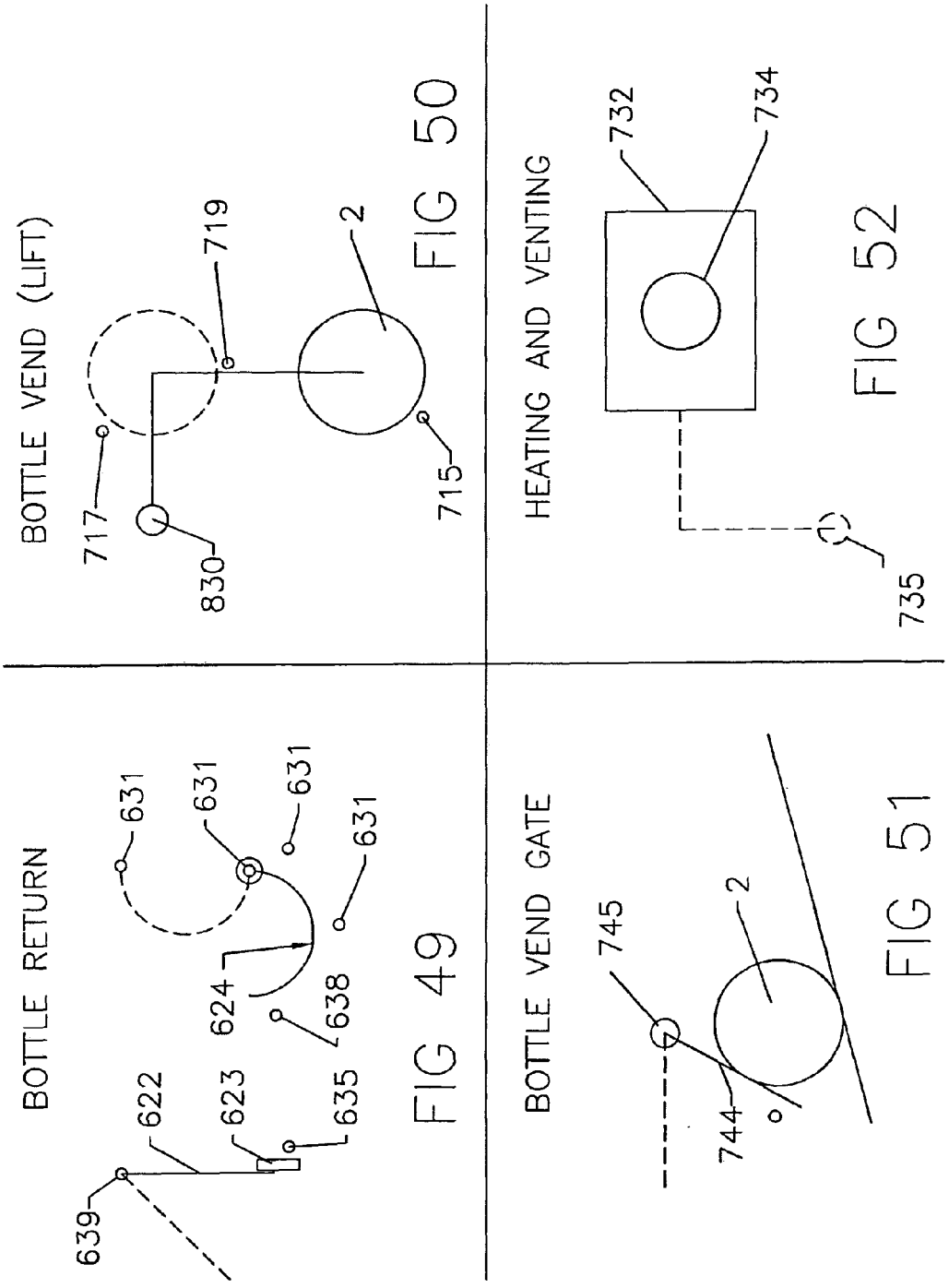



FIG 48


BOTTLE VEND (LIFT)
717
719
2
830
715
FIG 50
HEATING AND VENTING
732
734
735
FIG 52
BOTTLE RETURN
631
631
631
631
622
623
624
638
635
639
FIG 49
BOTTLE VEND GATE
745
2
744
FIG 51

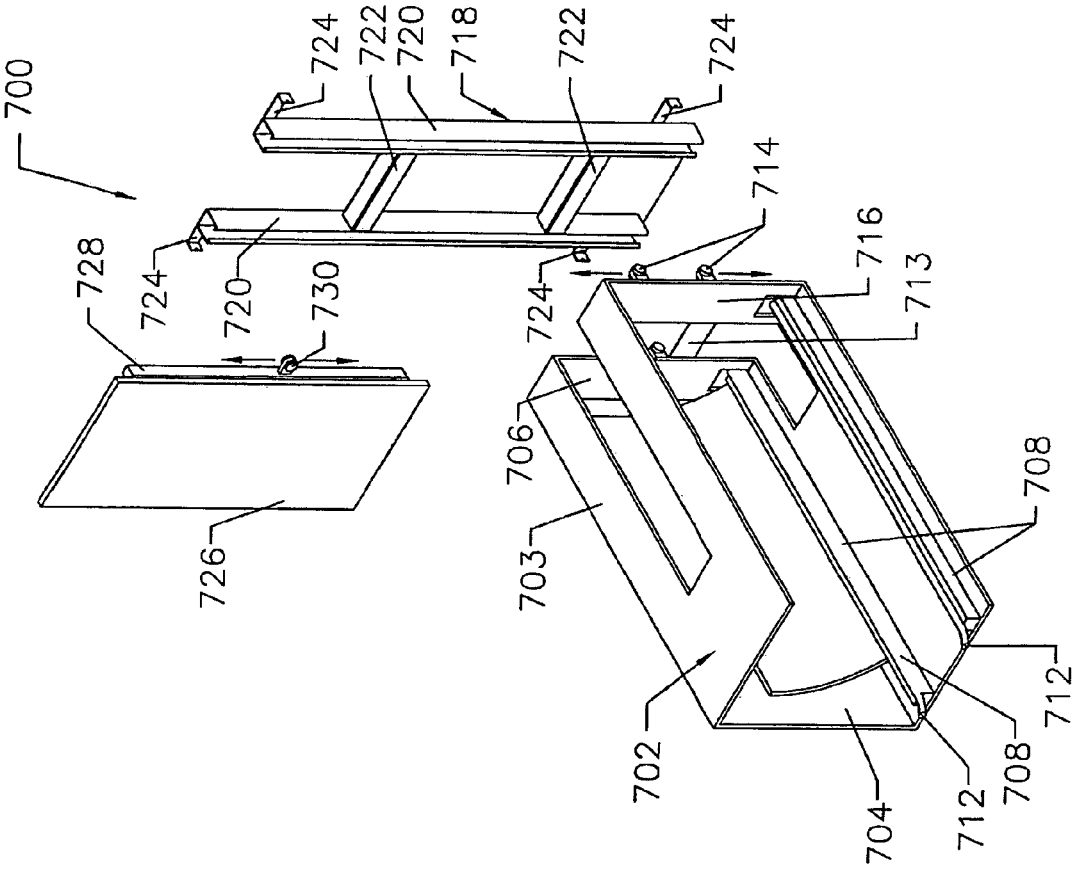

700
724
722
720
718
722
724
728
724
720
730
724
714
716
713
706
708
703
726
702
704
712
708
712

FIG 53

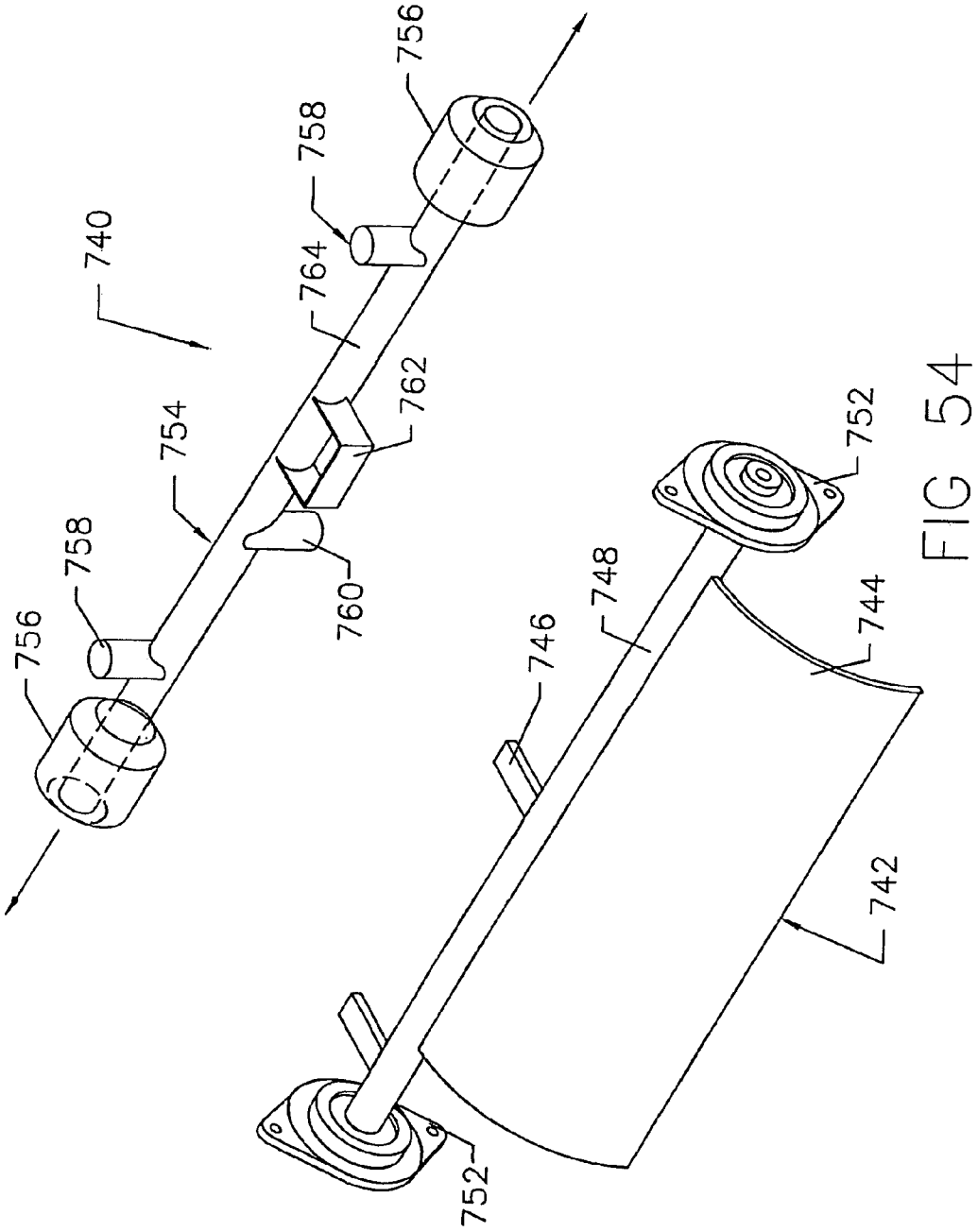



FIG 54

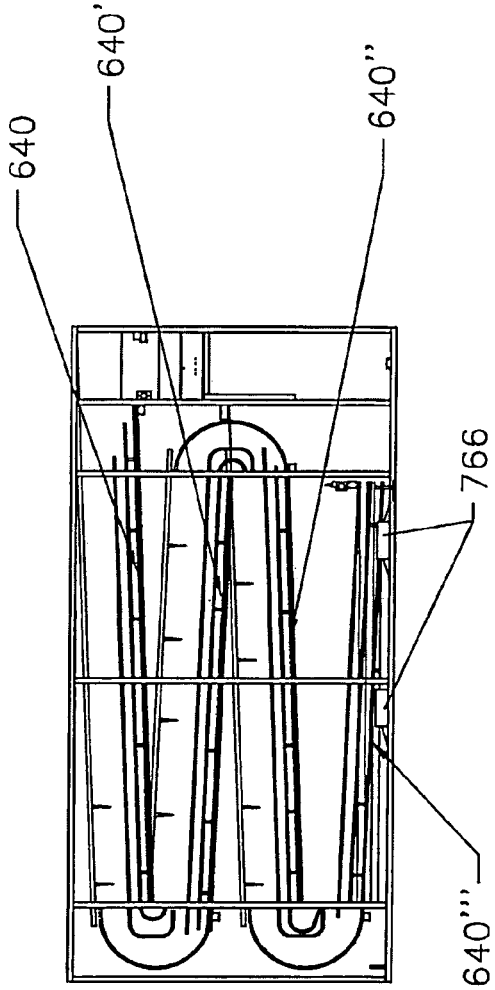



FIG 55

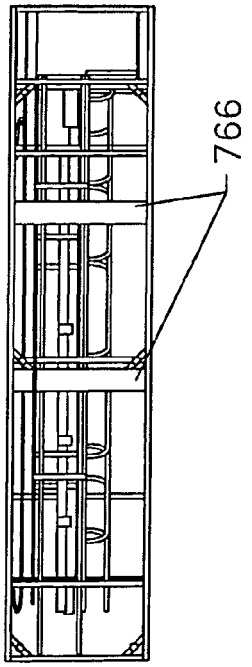



FIG 56

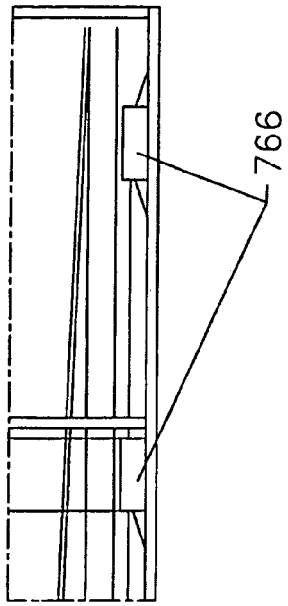



FIG 57

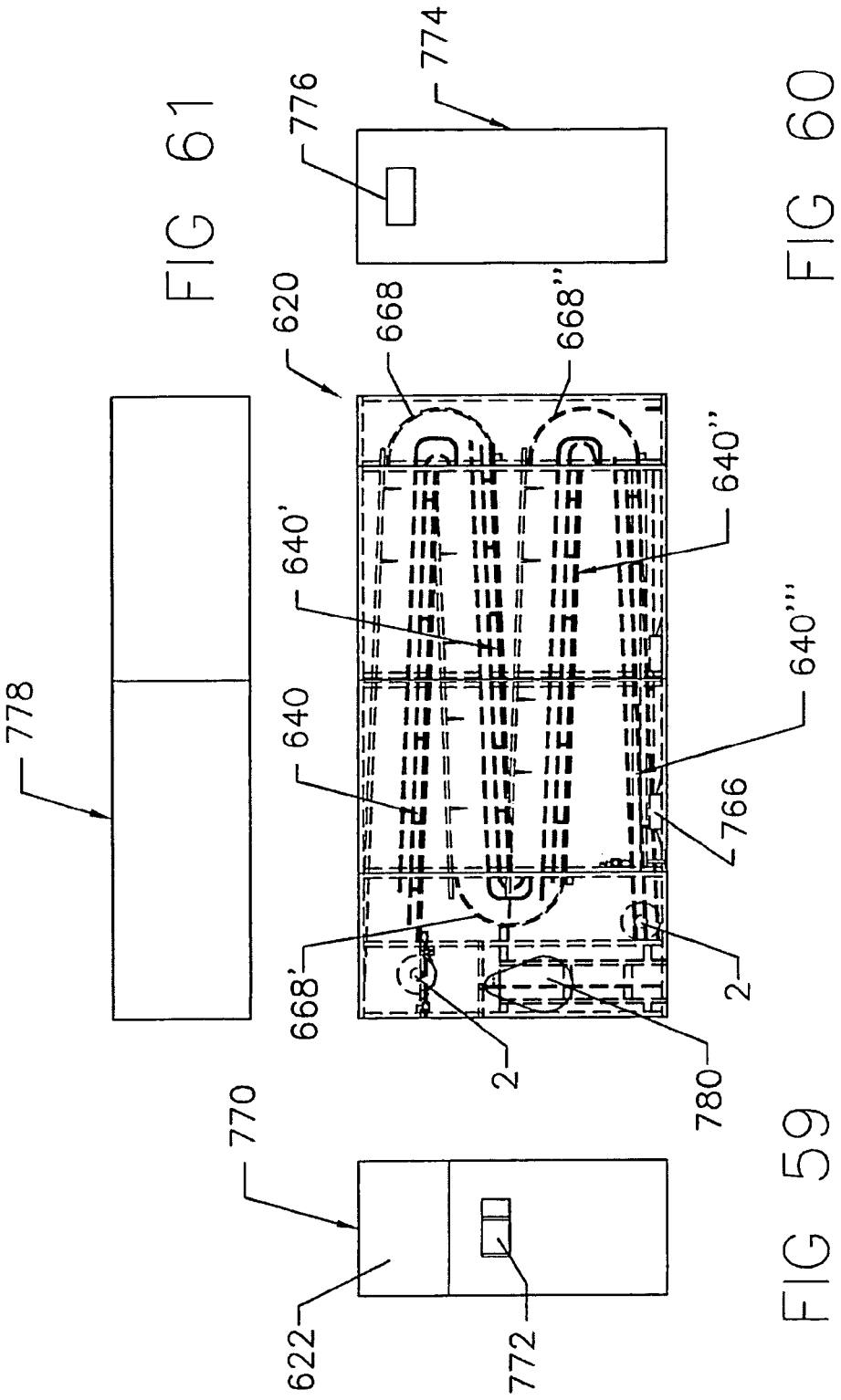



FIG 61

FIG 60

FIG 58

FIG 59

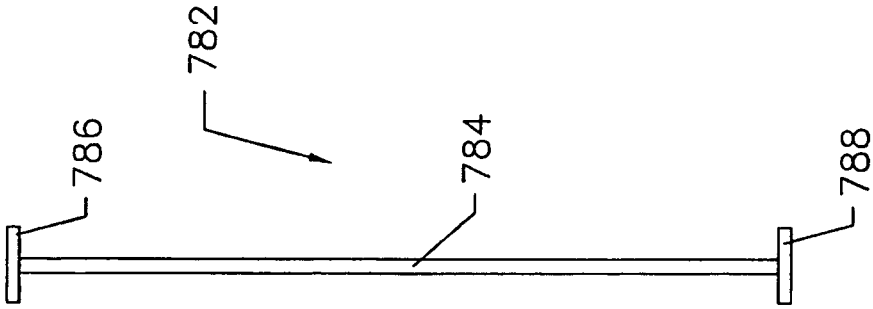



FIG 63

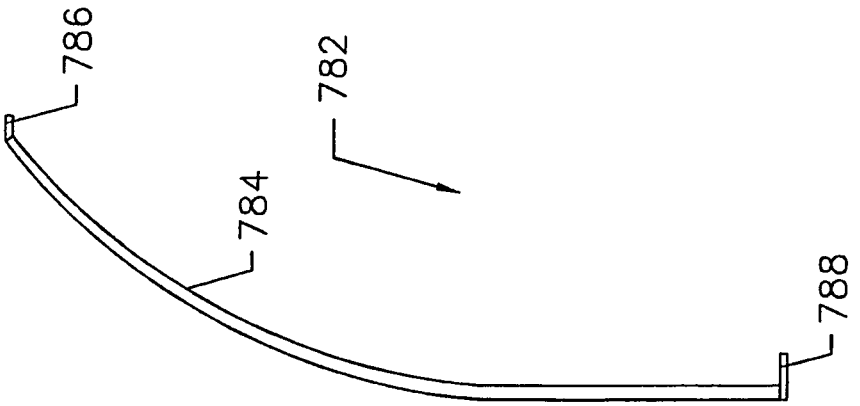



FIG 62

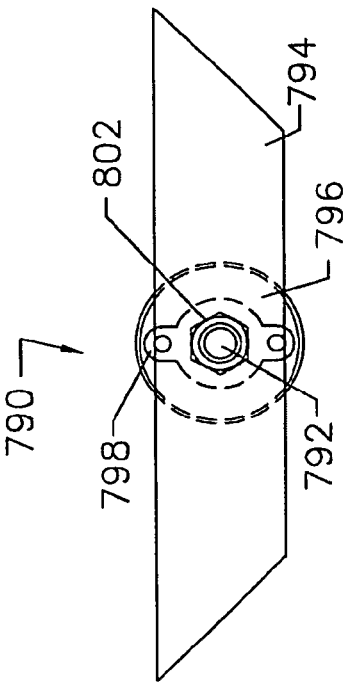



FIG 66

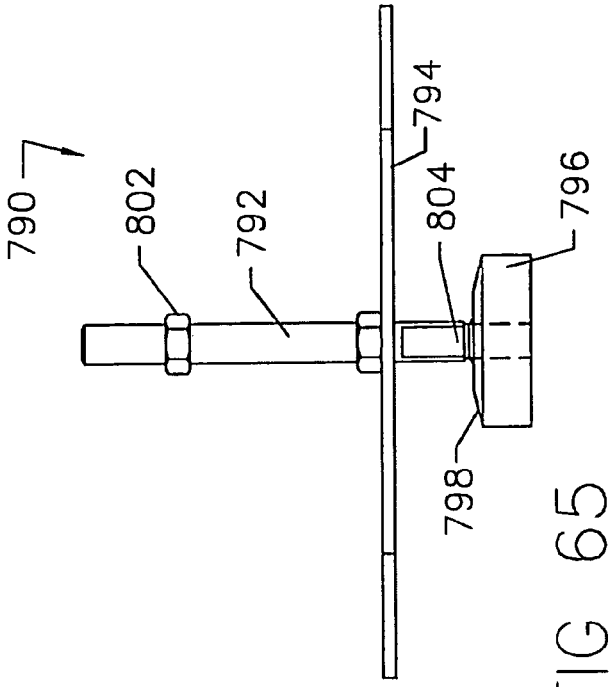



FIG 65

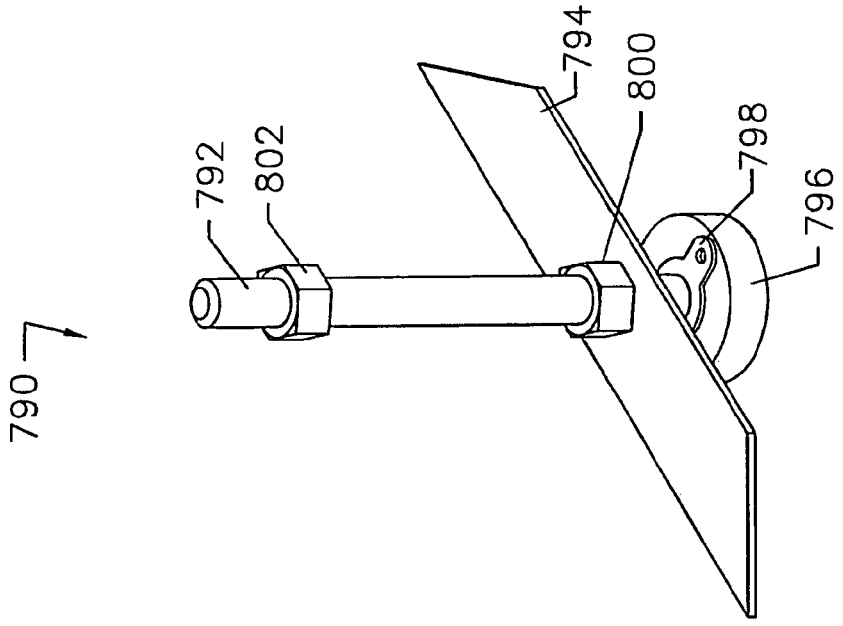



FIG 64

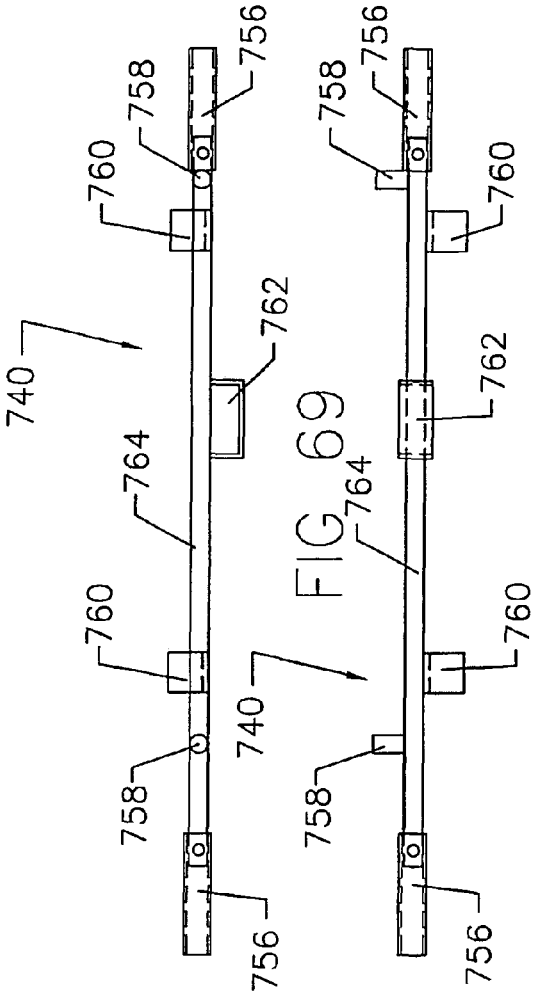



FIG 69




FIG 68

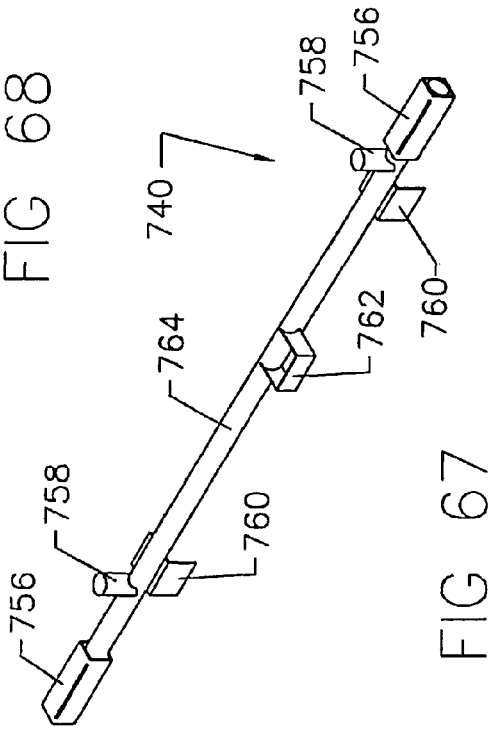



FIG 67

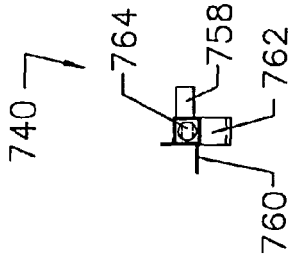



FIG 70

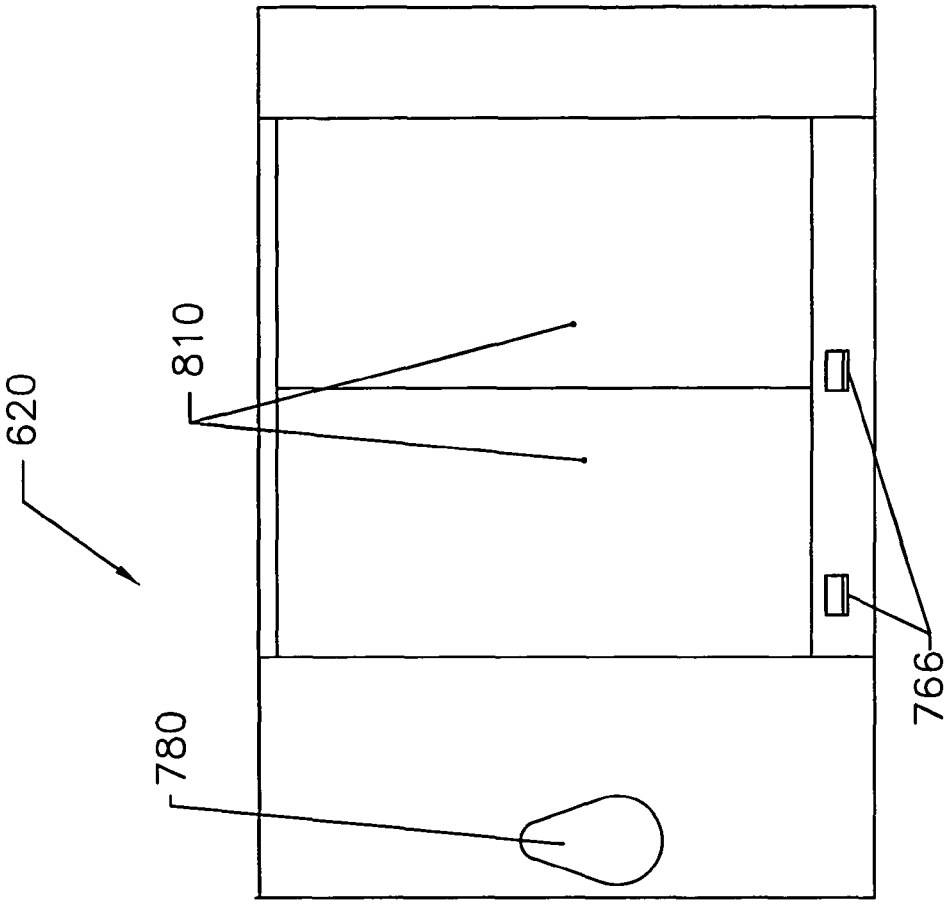



FIG 71

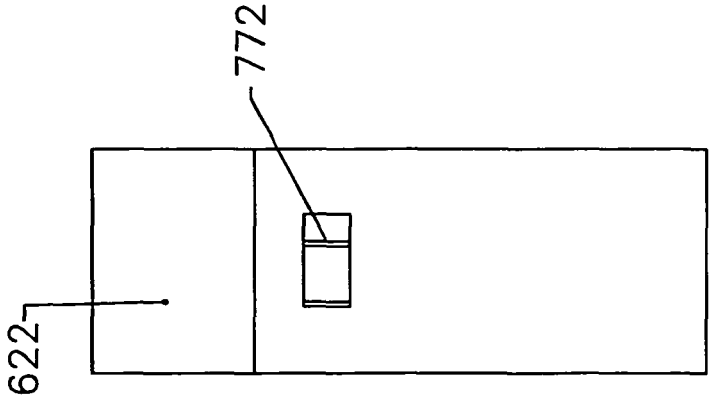



FIG 72

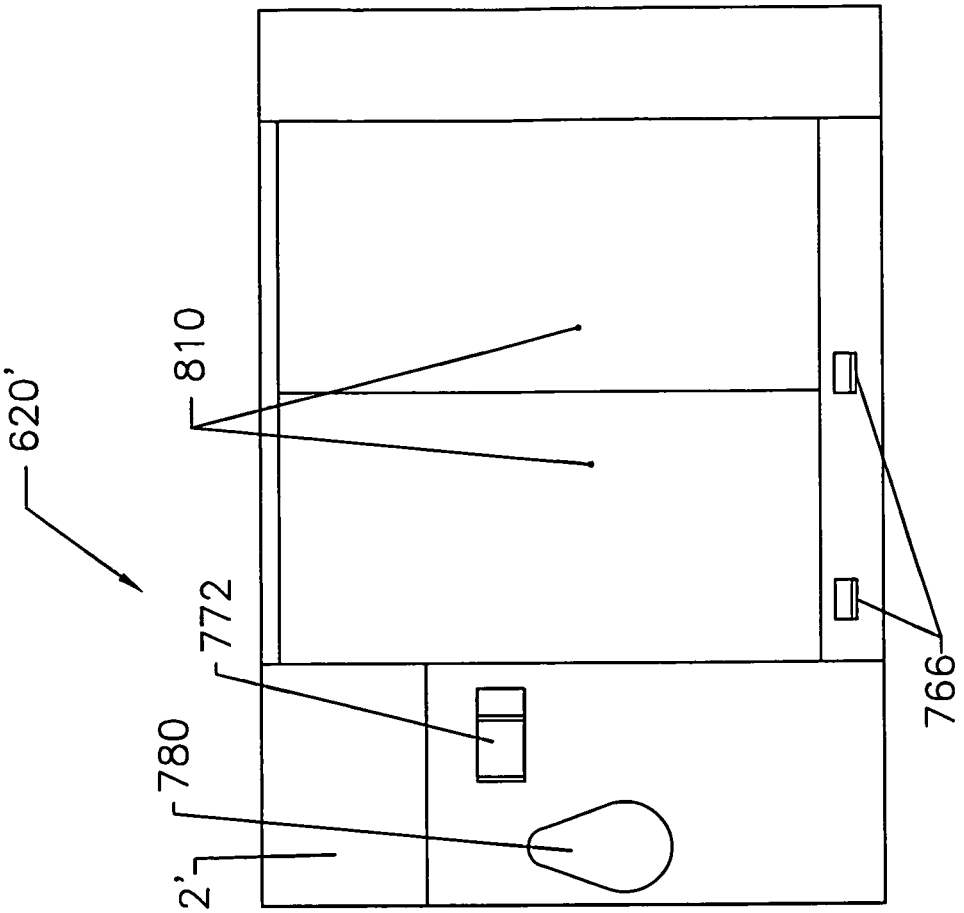



FIG 73

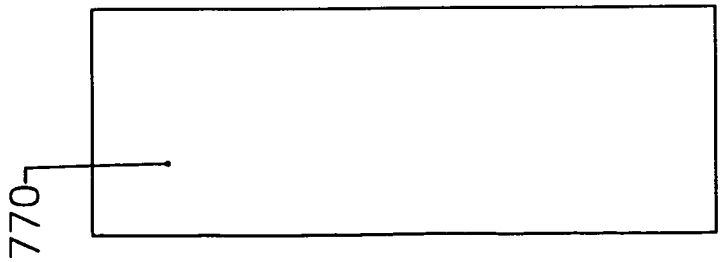



FIG 74

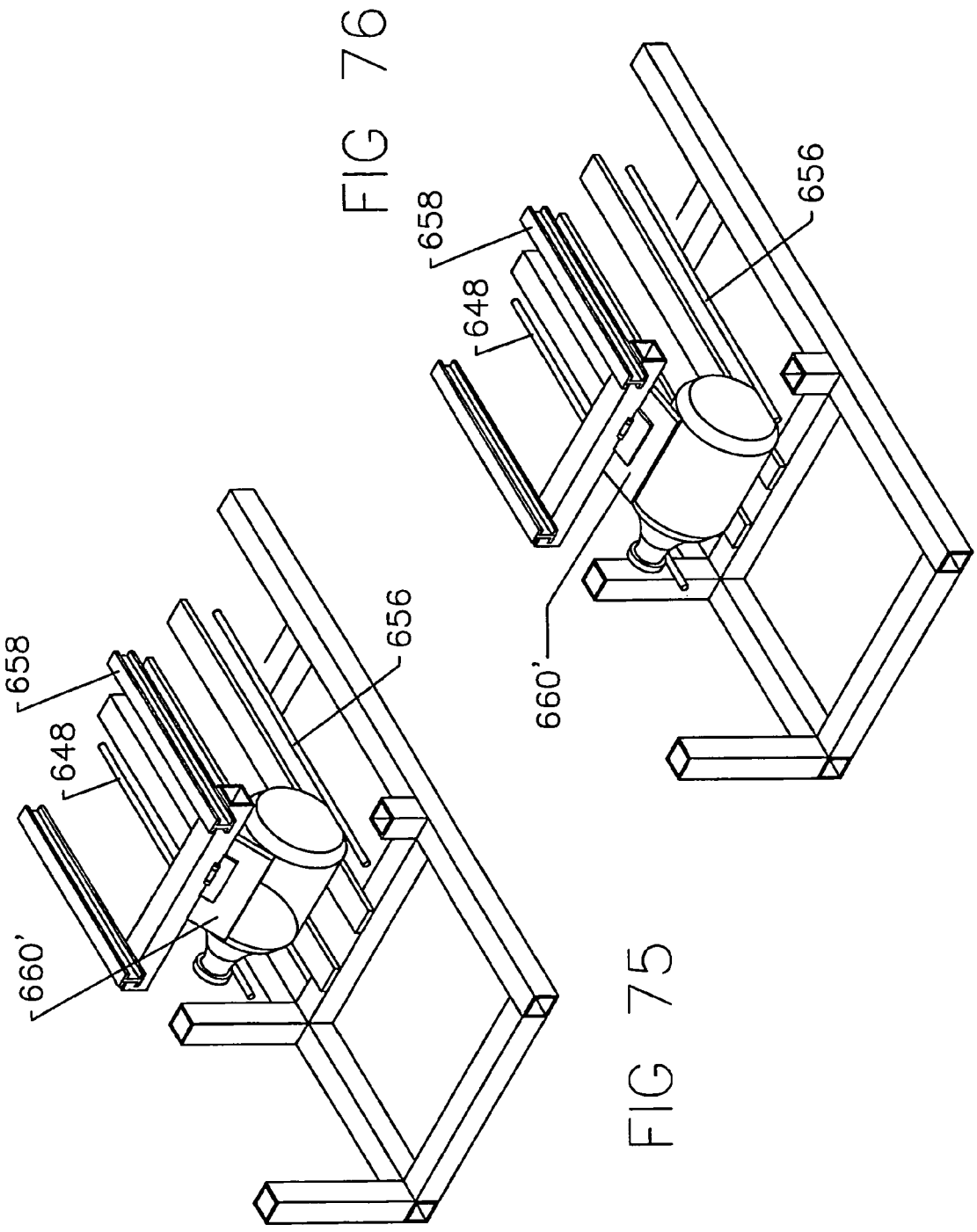



FIG 76




FIG 75

FIG 77

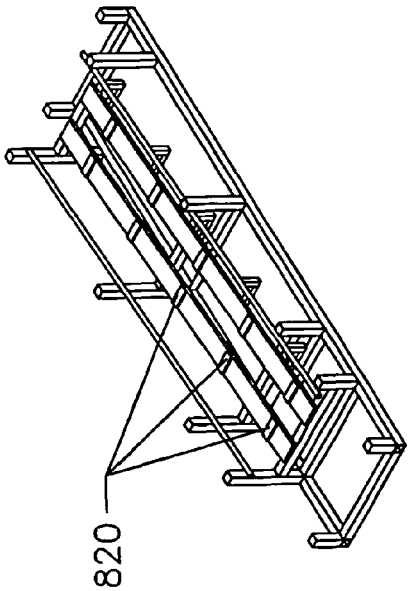
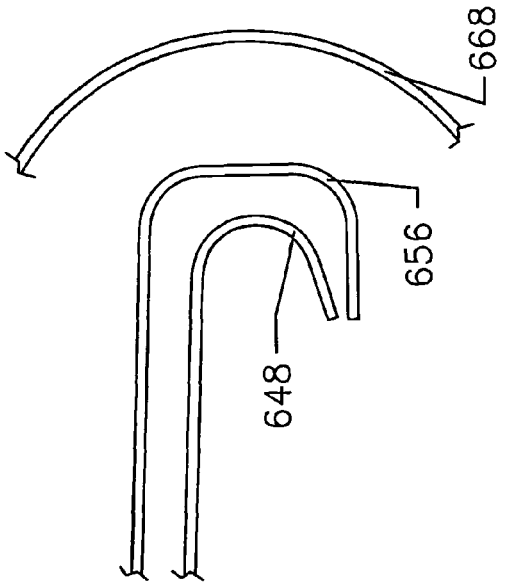



FIG 78



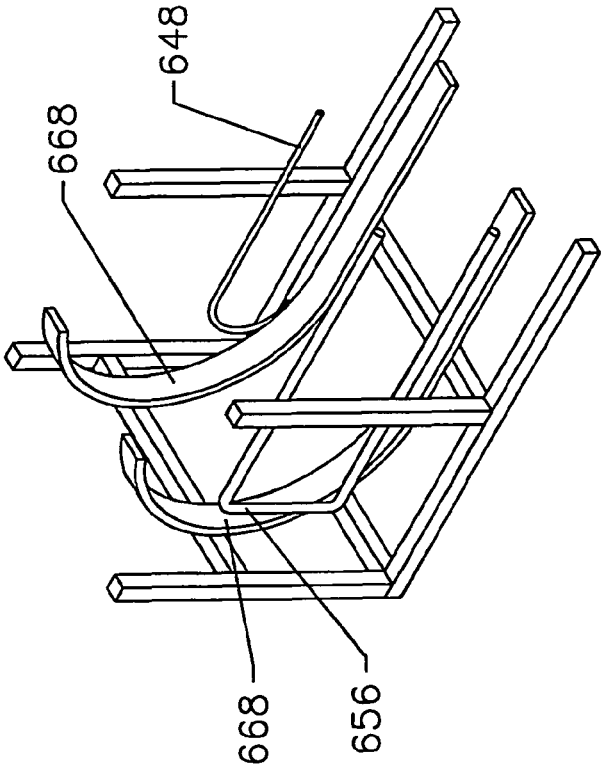



FIG 79

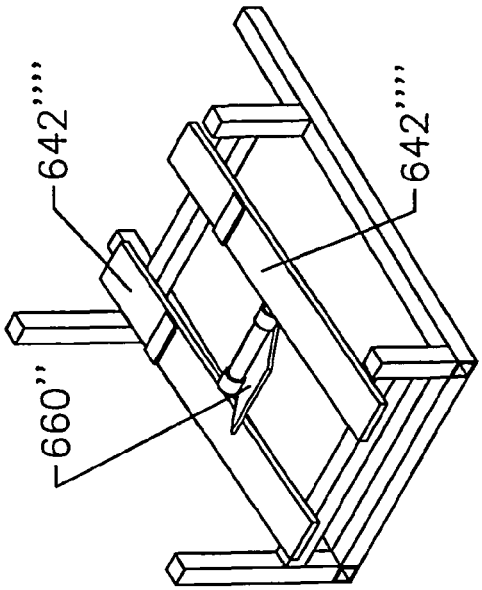



FIG 80

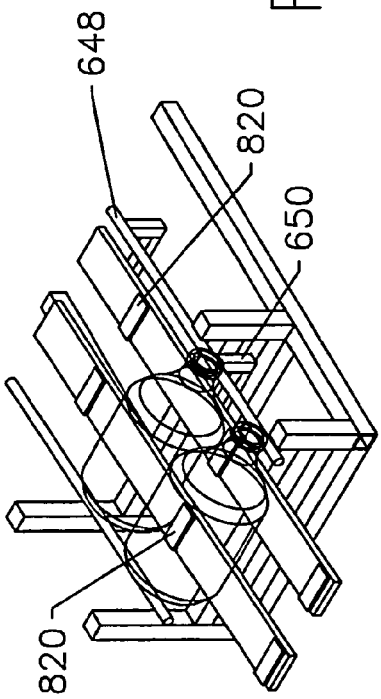



FIG 81

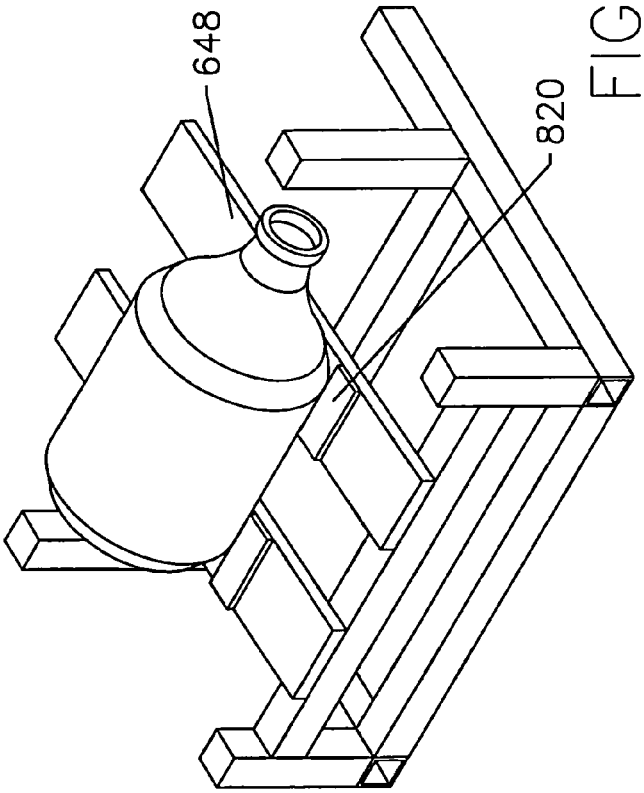



FIG 82

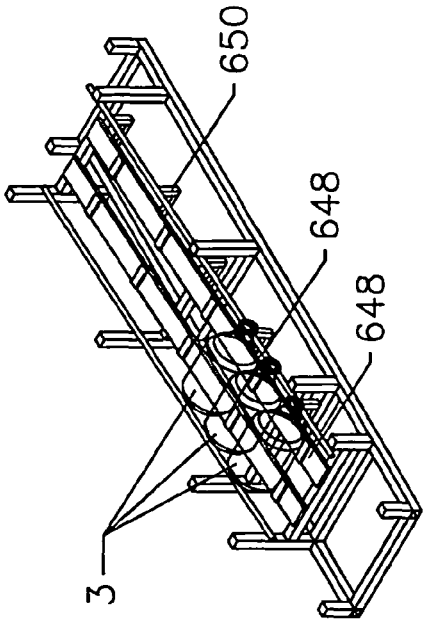



FIG 83

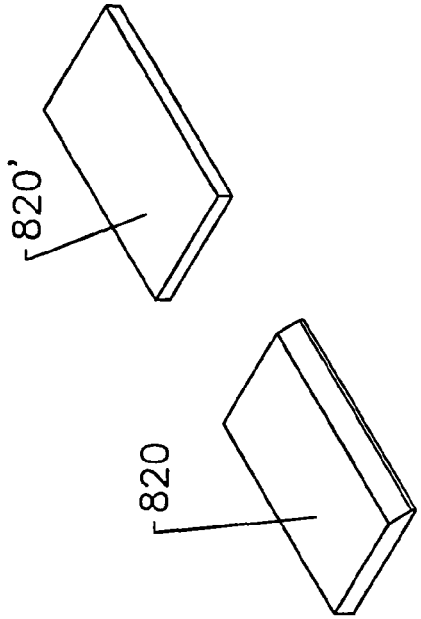
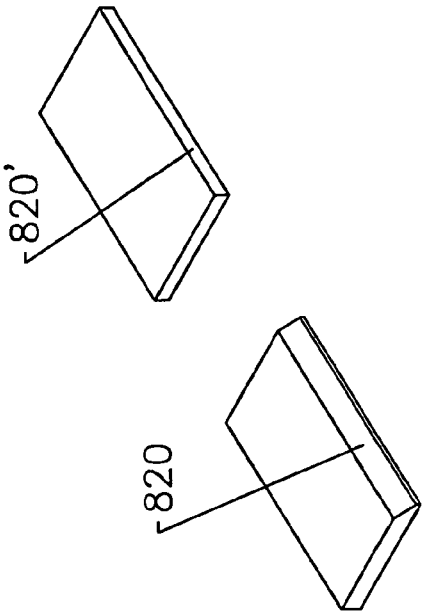



FIG 84

FIG 85


FIG 86



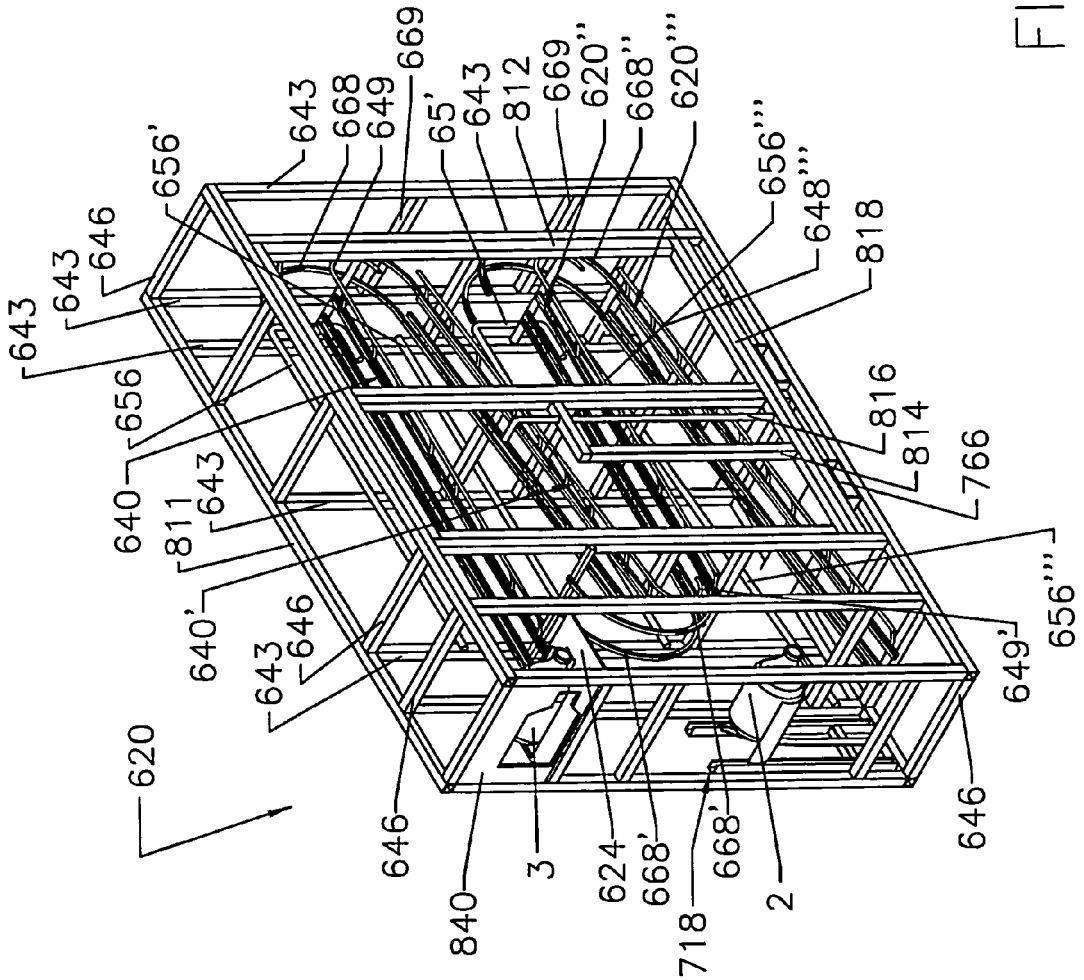

620
643
646
656'
643
668
649
669
65'
643
812
669
620''
668''
620'''
656'''
648'''
818
816
814
766
656'''
649'
646
668'
668'
624
3
840
646
646
643
640'
643
811
640
656
643
646

FIG 87

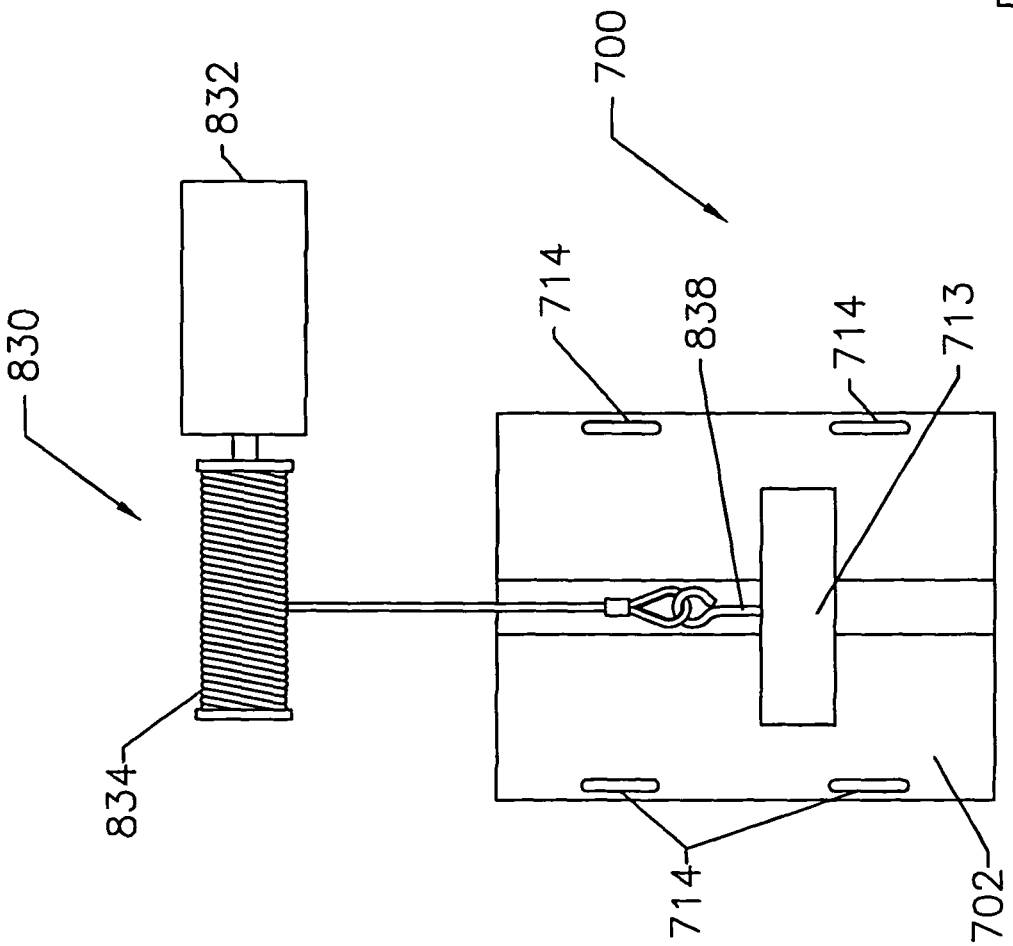



FIG 88

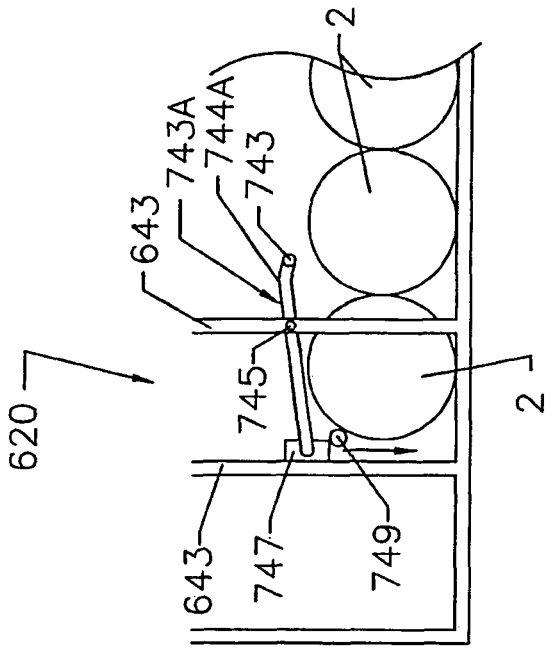

620
643
743A
744A
743
745
747
749
2
2

FIG 92

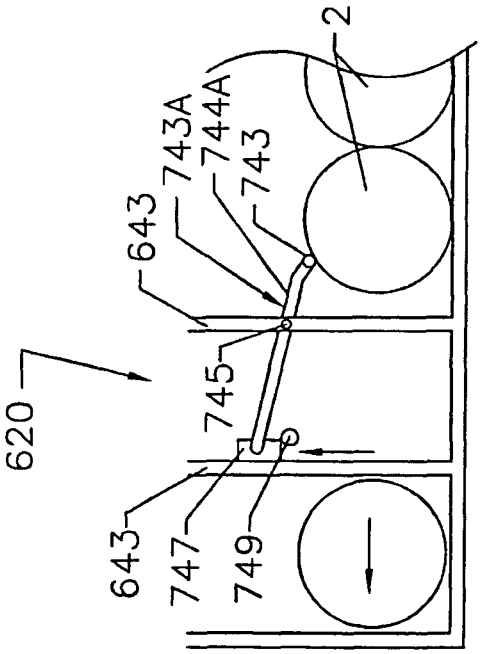

620
643
743A
744A
743
745
747
749
2

FIG 89

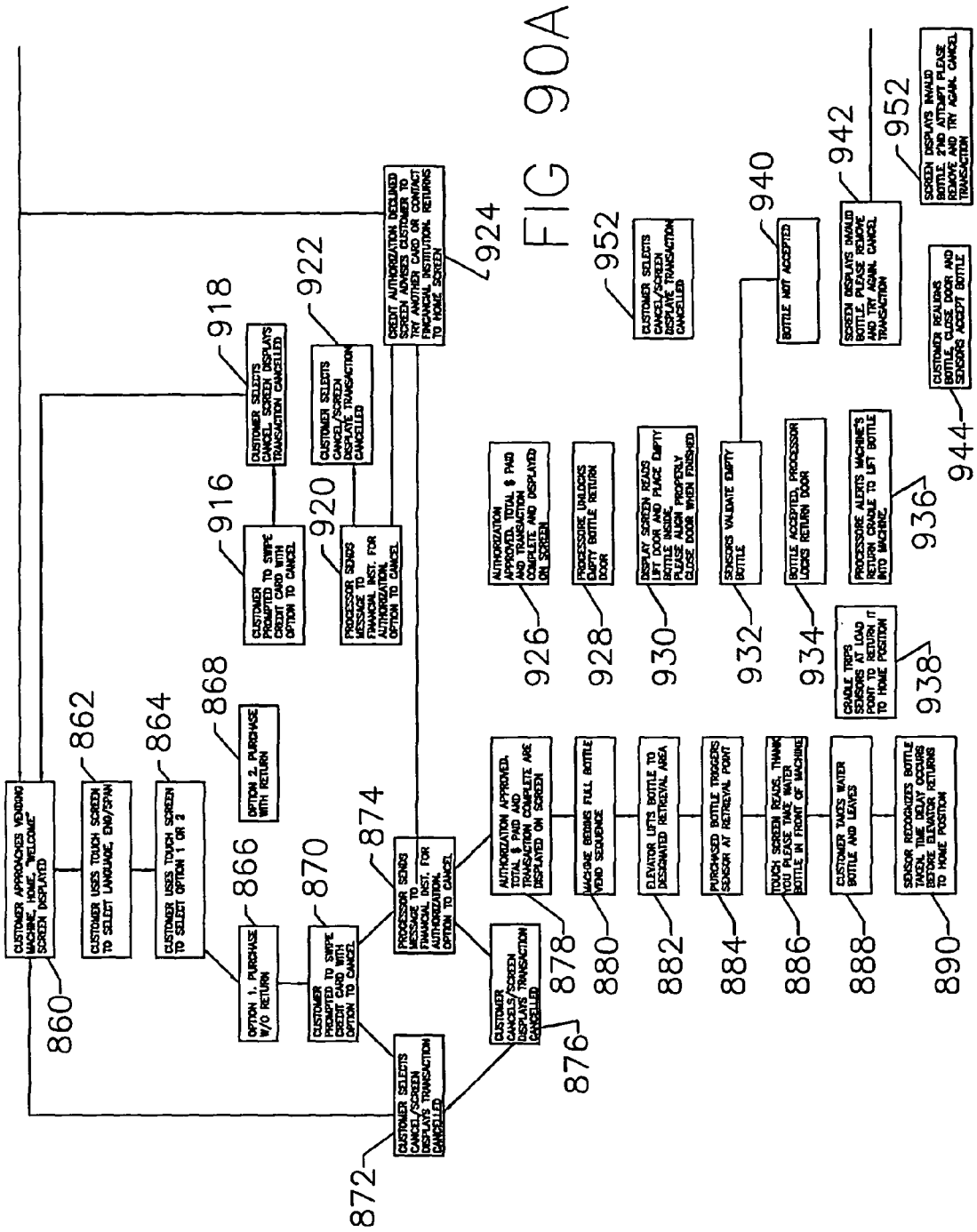

CUSTOMER APPROACHES VENDING MACHINE, HAPPY "WELCOME" SCREEN DISPLAYED
860
CUSTOMER USES TOUCH SCREEN TO SELECT LANGUAGE, ENG/SPAN
862
CUSTOMER USES TOUCH SCREEN TO SELECT OPTION 1 OR 2
864
OPTION 2, PURCHASE WITH RETURN
868
OPTION 1, PURCHASE W/O RETURN
866
CUSTOMER PROMPTED TO SWIPE CREDIT CARD WITH OPTION TO CANCEL
870
CUSTOMER SELECTS CANCEL/SCREEN DISPLAYS TRANSACTION CANCELLED
872
PROCESSOR SENDS MESSAGE TO FINANCIAL INST. FOR AUTHORIZATION, OPTION TO CANCEL
874
CUSTOMER CANCELS/SCREEN DISPLAYS TRANSACTION CANCELLED
876
AUTHORIZATION APPROVED, TOTAL $ PAID AND TRANSACTION COMPLETE ARE DISPLAYED ON SCREEN
878
MACHINE BEGINS FULL BOTTLE VEND SEQUENCE
880
ELEVATOR LIFTS BOTTLE TO DESIGNATED RETRIEVAL AREA
882
PURCHASED BOTTLE TRIGGERS SENSOR AT RETRIEVAL PORT
884
TOUCH SCREEN READS, THANK YOU PLEASE TAKE WATER BOTTLE IN FRONT OF MACHINE
886
CUSTOMER TAKES WATER BOTTLE AND LEAVES
888
SENSOR RECOGNIZES BOTTLE TAKEN, TIME DELAY OCCURS BEFORE ELEVATOR RETURNS TO HOME POSITION
890
CUSTOMER SELECTS CANCEL/SCREEN DISPLAYS TRANSACTION CANCELLED
916
CUSTOMER SELECTS CANCEL SCREEN DISPLAYS TRANSACTION CANCELLED
918
CUSTOMER PROMPTED TO SWIPE CREDIT CARD WITH OPTION TO CANCEL
920
CUSTOMER SELECTS CANCEL/SCREEN DISPLAYS TRANSACTION CANCELLED
922
PROCESSOR SENDS MESSAGE TO FINANCIAL INST. FOR AUTHORIZATION, OPTION TO CANCEL
924
CREDIT AUTHORIZATION DECLINED SCREEN APPROPRIATE OPTION TO TRY ANOTHER CARD OR CONTACT FINANCIAL INSTITUTION, RETURNS TO HOME SCREEN
926
AUTHORIZATION APPROVED, TOTAL $ PAID AND TRANSACTION COMPLETE AND DISPLAYED ON SCREEN
928
PROCESSOR UNLOCKS EMPTY BOTTLE RETURN DOOR
930
DISPLAY SCREEN READS LIFT DOOR AND PLACE EMPTY BOTTLE INSIDE, PLEASE ALSO PROPERLY CLOSE DOOR WHEN FINISHED
932
SENSORS VALIDATE EMPTY BOTTLE
934
BOTTLE ACCEPTED, PROCESSOR LOCKS RETURN DOOR
936
PROCESSOR ALERTS MACHINE'S RETURN CRADLE TO LIFT BOTTLE INTO MACHINE
938
CRADLE TRIPS SENSORS AT LOAD POINT TO RETURN IT TO HOME POSITION
940
BOTTLE NOT ACCEPTED
942
SCREEN DISPLAYS INVALID BOTTLE, PLEASE REMOVE AND TRY AGAIN, CANCEL TRANSACTION
944
CUSTOMER REVIEWS BOTTLE, CLOSE DOOR AND SENSORS ACCEPT BOTTLE
952
SCREEN DISPLAYS INVALID BOTTLE, 2ND ATTEMPT PLEASE REMOVE AND TRY AGAIN, CANCEL TRANSACTION
952

FIG 90A

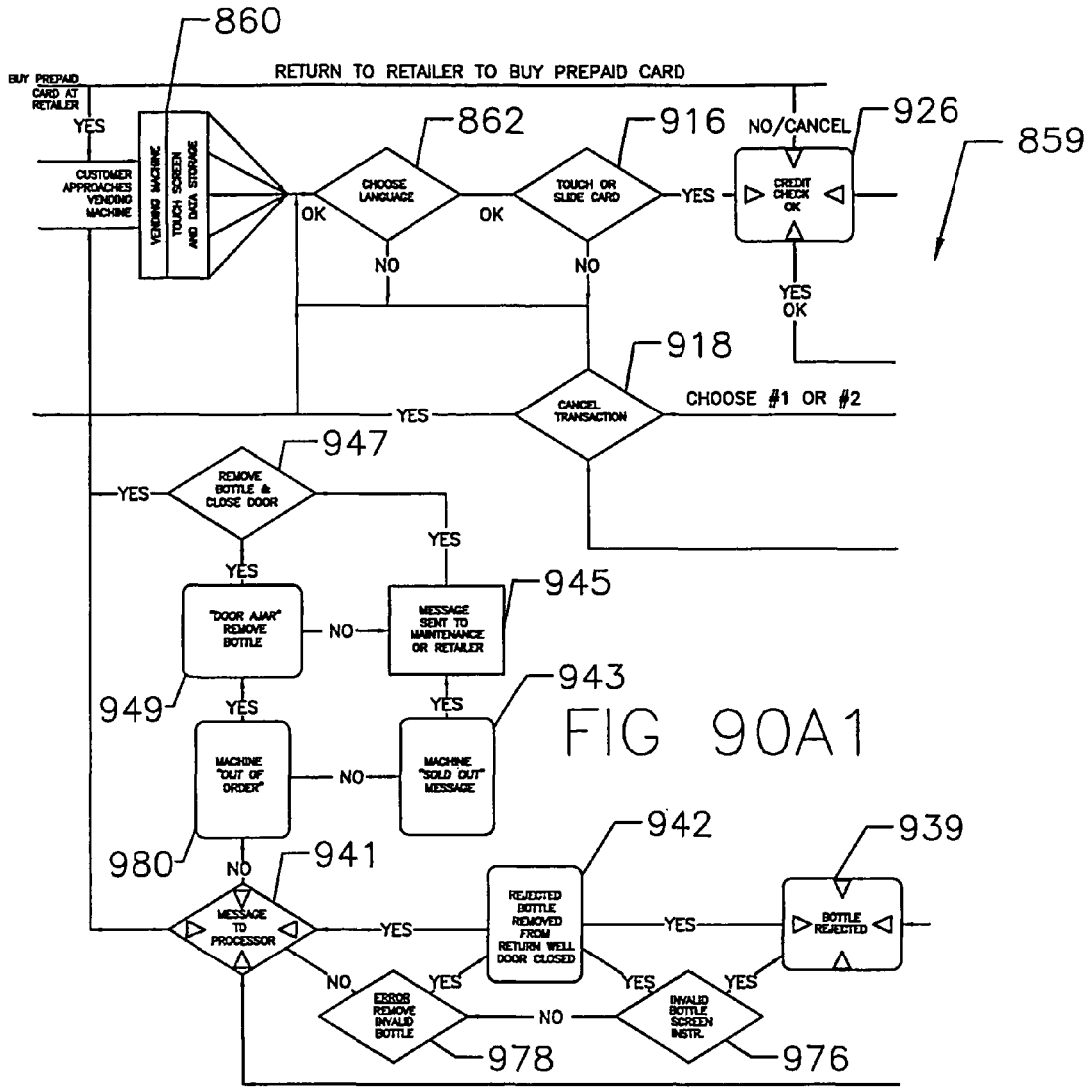

860
BUY PREPAID CARD AT RETAILER
RETURN TO RETAILER TO BUY PREPAID CARD
YES
CUSTOMER APPROACHES VENDING MACHINE
VENDING MACHINE TOUCH SCREEN AND DATA STORAGE
862
CHOOSE LANGUAGE
OK
NO
916
TOUCH OR SLIDE CARD
OK
NO
YES
NO/CANCEL
926
CREDIT CHECK OK
YES OK
859
918
CANCEL TRANSACTION
YES
CHOOSE #1 OR #2
947
REMOVE BOTTLE & CLOSE DOOR
YES
YES
YES
"DOOR AJAR" REMOVE BOTTLE
NO
945
MESSAGE SENT TO MAINTENANCE OR RETAILER
949
YES
YES
943
MACHINE "OUT OF ORDER"
NO
MACHINE "SOLD OUT" MESSAGE
980
NO
941
MESSAGE TO PROCESSOR
YES
942
REJECTED BOTTLE REMOVED FROM RETURN WELL DOOR CLOSED
YES
939
BOTTLE REJECTED
NO
YES
YES
YES
ERROR REMOVE INVALID BOTTLE
NO
INVALID BOTTLE SCREEN INSTR.
978
976

FIG 90A1

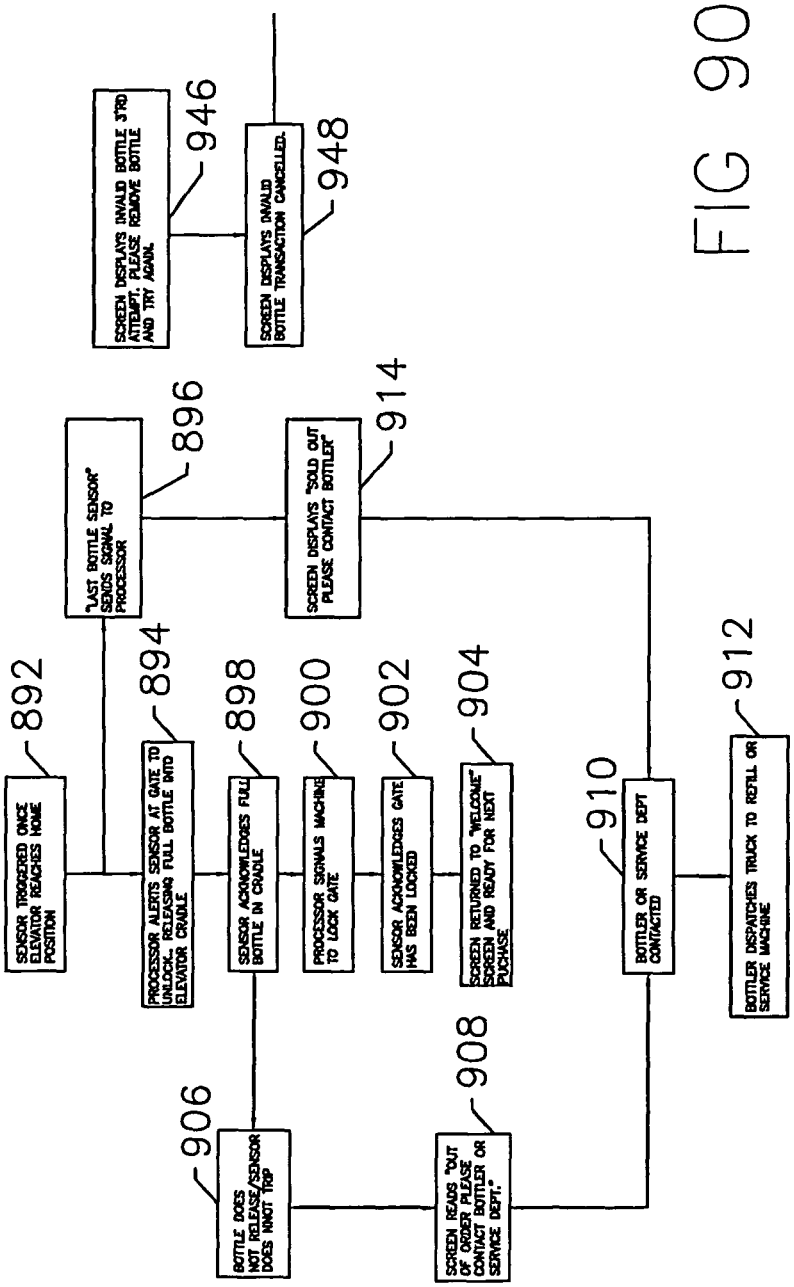

SENSOR TRIGGERED ONCE ELEVATOR REACHES HOME POSITION
892
PROCESSOR ALERTS SENSOR AT GATE TO UNLOCK, RELEASING FULL BOTTLE INTO ELEVATOR CRADLE
894
SENSOR ACKNOWLEDGES FULL BOTTLE IN CRADLE
898
PROCESSOR SIGNALS MACHINE TO LOCK GATE
900
SENSOR ACKNOWLEDGES GATE HAS BEEN LOCKED
902
SCREEN RETURNED TO "WELCOME" SCREEN AND READY FOR NEXT PURCHASE
904
BOTTLE DOES NOT RELEASE/SENSOR DOES NOT TRIP
906
SCREEN READS "OUT OF ORDER PLEASE CONTACT BOTTLER OR SERVICE DEPT."
908
BOTTLER OR SERVICE DEPT CONTACTED
910
BOTTLER DISPATCHES TRUCK TO REFILL OR SERVICE MACHINE
912
"LAST BOTTLE SENSOR" SENDS SIGNAL TO PROCESSOR
896
SCREEN DISPLAYS "SOLD OUT PLEASE CONTACT BOTTLER"
914
SCREEN DISPLAYS INVALID BOTTLE 3RD ATTEMPT. PLEASE REMOVE BOTTLE AND TRY AGAIN.
946
SCREEN DISPLAYS INVALID BOTTLE TRANSACTION CANCELLED.
948

FIG 90B

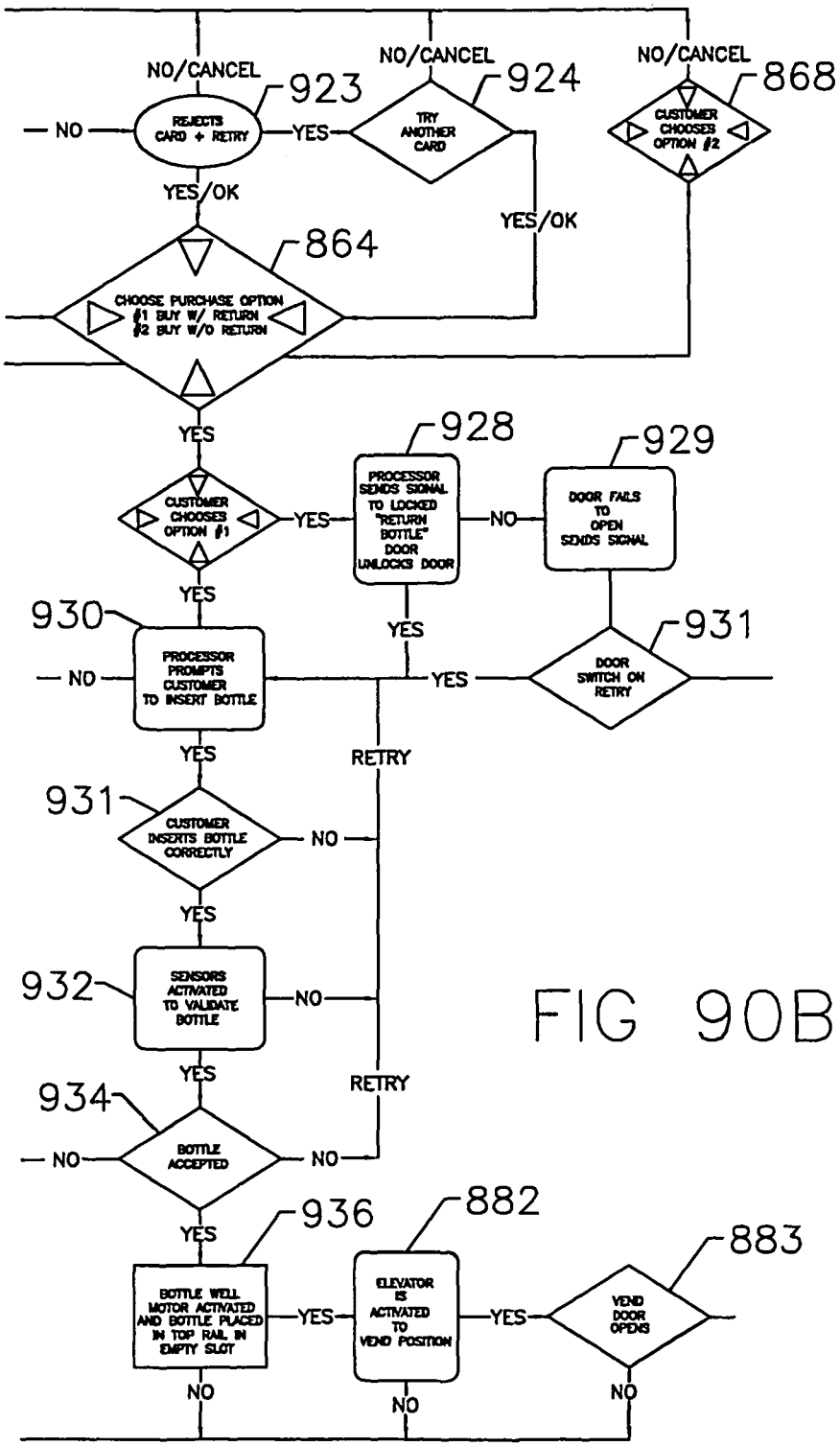

NO/CANCEL
923
REJECTS CARD + RETRY
NO
YES
NO/CANCEL
924
TRY ANOTHER CARD
NO/CANCEL
868
CUSTOMER CHOOSES OPTION #2
YES/OK
YES/OK
864
CHOOSE PURCHASE OPTION
#1 BUY W/ RETURN
#2 BUY W/O RETURN
YES
928
CUSTOMER CHOOSES OPTION #1
YES
PROCESSOR SENDS SIGNAL TO LOCKED "RETURN BOTTLE" DOOR UNLOCKS DOOR
NO
929
DOOR FAILS TO OPEN SENDS SIGNAL
YES
930
PROCESSOR PROMPTS CUSTOMER TO INSERT BOTTLE
NO
YES
931
DOOR SWITCH ON RETRY
YES
RETRY
931
CUSTOMER INSERTS BOTTLE CORRECTLY
NO
YES
932
SENSORS ACTIVATED TO VALIDATE BOTTLE
NO
YES
RETRY
934
BOTTLE ACCEPTED
NO
NO
YES
936
BOTTLE WELL MOTOR ACTIVATED AND BOTTLE PLACED IN TOP RAIL IN EMPTY SLOT
YES
882
ELEVATOR IS ACTIVATED TO VEND POSITION
YES
883
VEND DOOR OPENS
NO
NO
NO

FIG 90B1

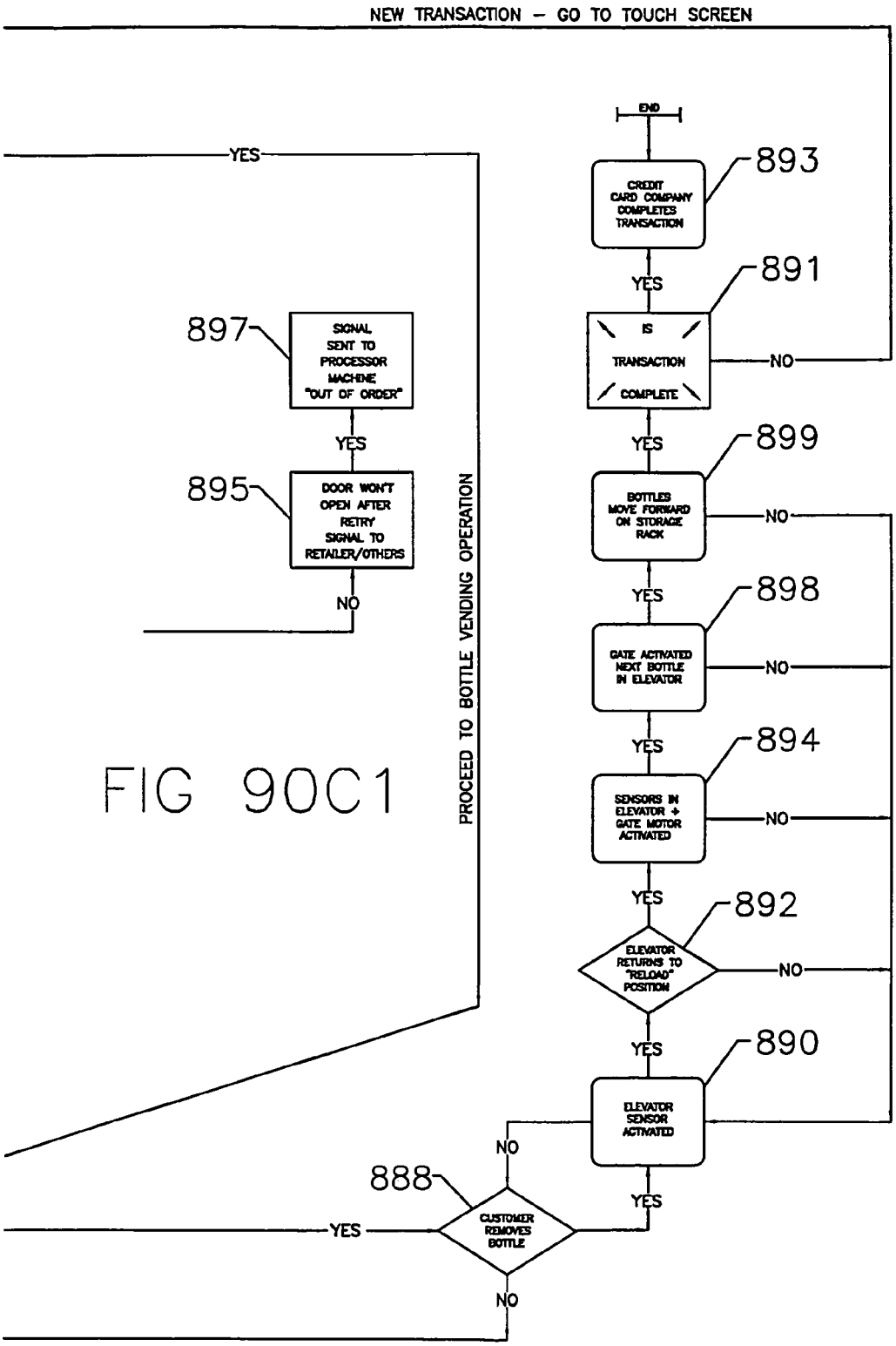

NEW TRANSACTION – GO TO TOUCH SCREEN
END
893
CREDIT CARD COMPANY COMPLETES TRANSACTION
YES
891
IS TRANSACTION COMPLETE
NO
YES
899
BOTTLES MOVE FORWARD ON STORAGE RACK
NO
YES
898
GATE ACTIVATED NEXT BOTTLE IN ELEVATOR
NO
YES
894
SENSORS IN ELEVATOR + GATE MOTOR ACTIVATED
NO
YES
892
ELEVATOR RETURNS TO "RELOAD" POSITION
NO
YES
890
ELEVATOR SENSOR ACTIVATED
NO
YES
888
CUSTOMER REMOVES BOTTLE
YES
NO
897
SIGNAL SENT TO PROCESSOR MACHINE "OUT OF ORDER"
YES
895
DOOR WON'T OPEN AFTER RETRY SIGNAL TO RETAILER/OTHERS
NO
YES
PROCEED TO BOTTLE VENDING OPERATION

FIG 90C1

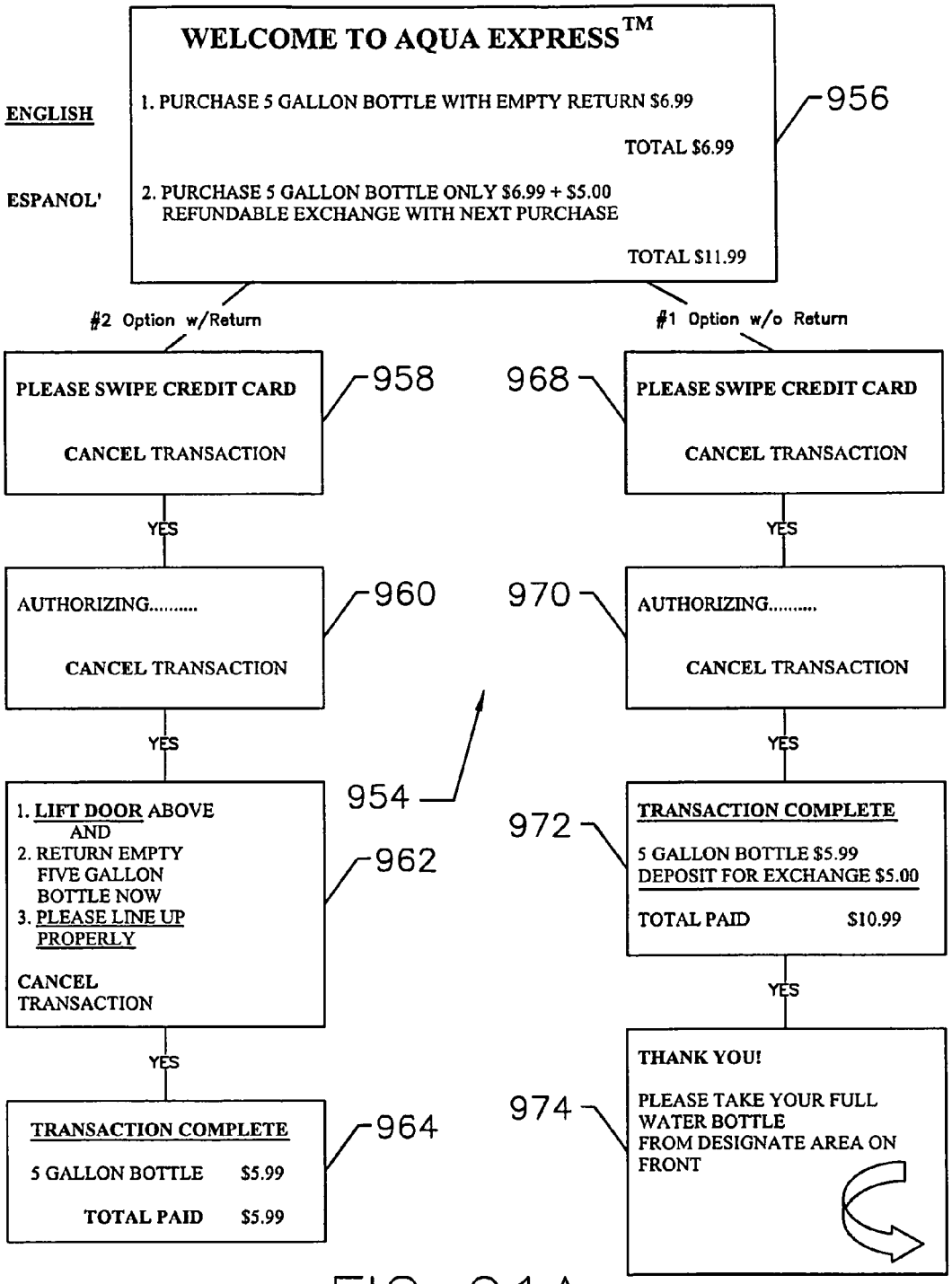
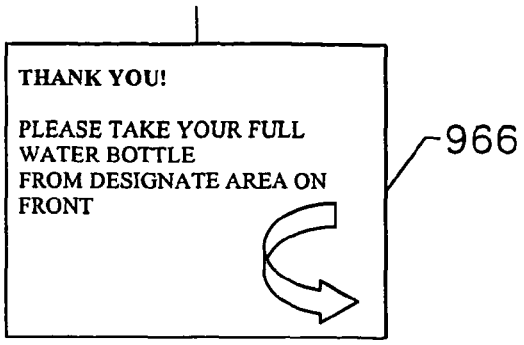
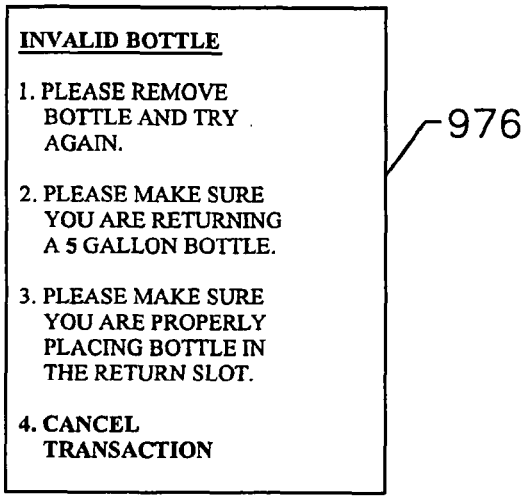

WELCOME TO AQUA EXPRESS™
ENGLISH
1. PURCHASE 5 GALLON BOTTLE WITH EMPTY RETURN $6.99
TOTAL $6.99
ESPANOL'
2. PURCHASE 5 GALLON BOTTLE ONLY $6.99 + $5.00 REFUNDABLE EXCHANGE WITH NEXT PURCHASE
TOTAL $11.99
956
#2 Option w/Return
#1 Option w/o Return
PLEASE SWIPE CREDIT CARD
CANCEL TRANSACTION
958
968
YES
AUTHORIZING.....
CANCEL TRANSACTION
960
970
954
1. LIFT DOOR ABOVE AND
2. RETURN EMPTY FIVE GALLON BOTTLE NOW
3. PLEASE LINE UP PROPERLY
CANCEL TRANSACTION
962
TRANSACTION COMPLETE
5 GALLON BOTTLE $5.99
TOTAL PAID $5.99
964
5 GALLON BOTTLE $5.99
DEPOSIT FOR EXCHANGE $5.00
TOTAL PAID $10.99
972
THANK YOU!
PLEASE TAKE YOUR FULL WATER BOTTLE FROM DESIGNATE AREA ON FRONT
974

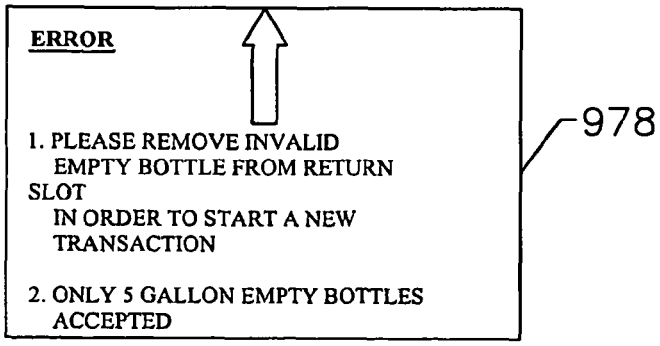
FIG 91A



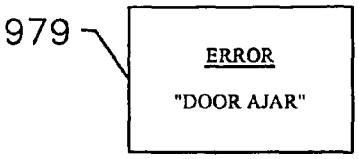

**PROBLEMS THAT CAN HAPPEN WITH THE OPTION RETURNING AN EMPTYBOTTLE**

FIG 91B



PROBLEMS THAT CAN HAPPEN WITH BOTH OPTIONS



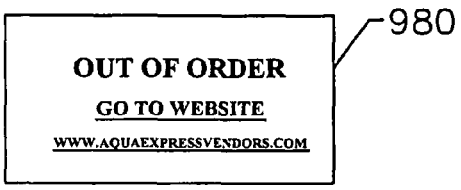
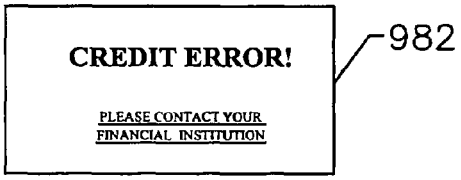
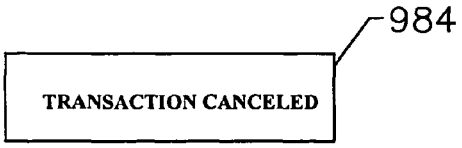




FIG 91C




IF THE CANCEL TRANSACTION BUTTON WAS PUSHED



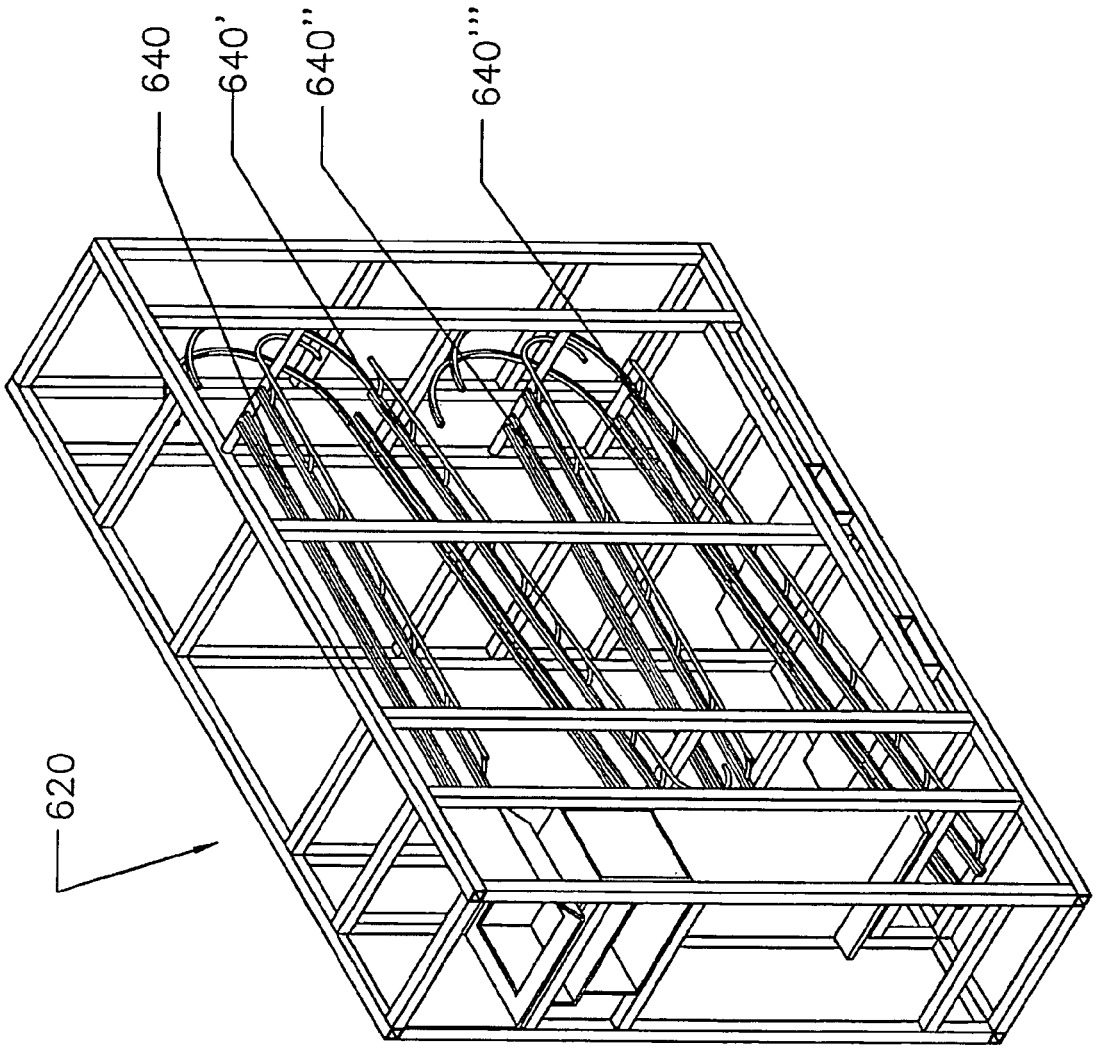



FIG 93

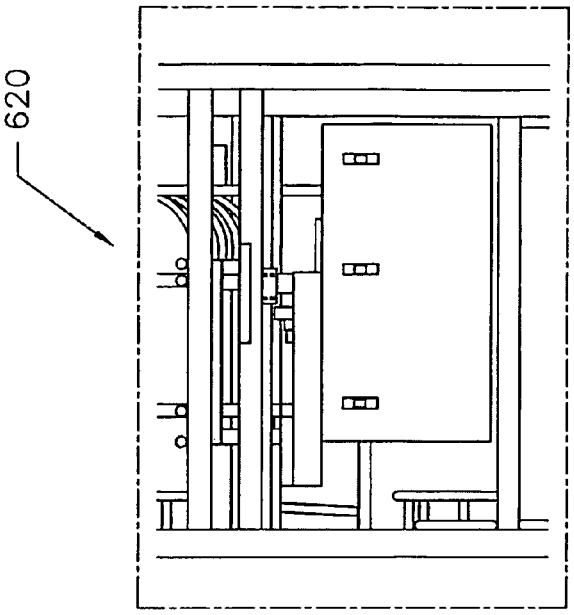



FIG 95

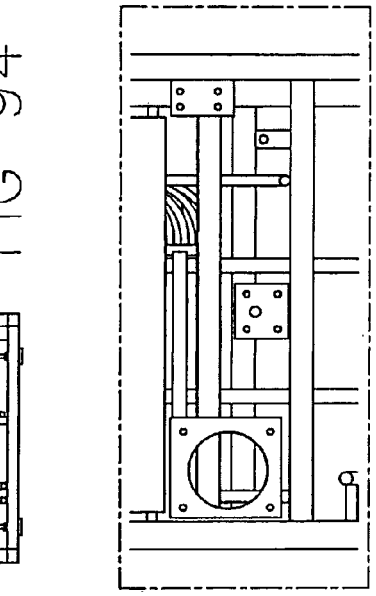



FIG 96

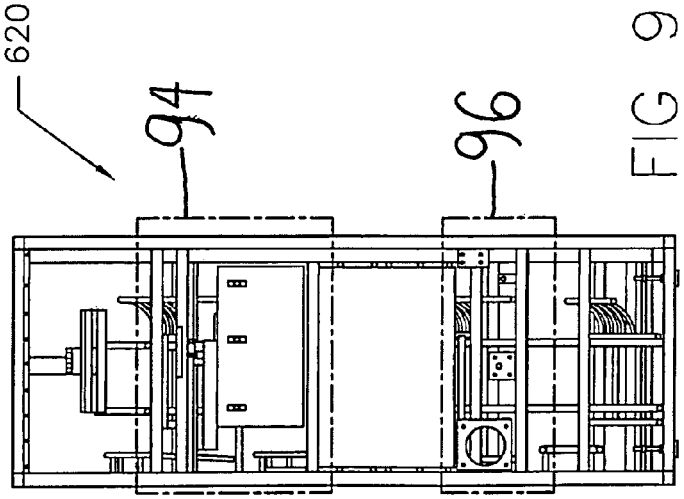



FIG 94

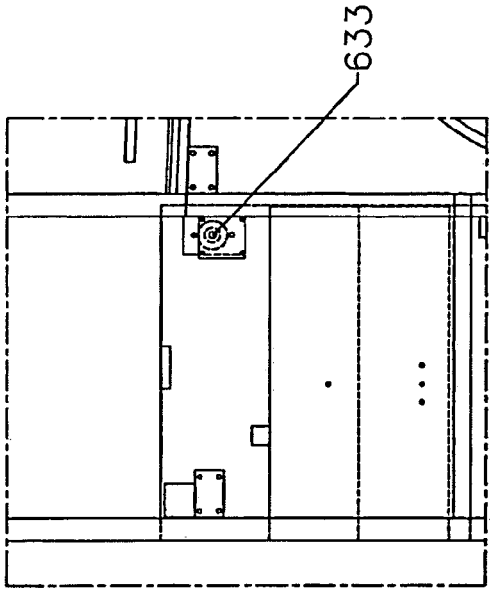



FIG 98

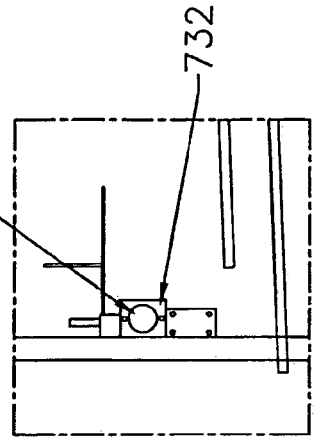



FIG 99

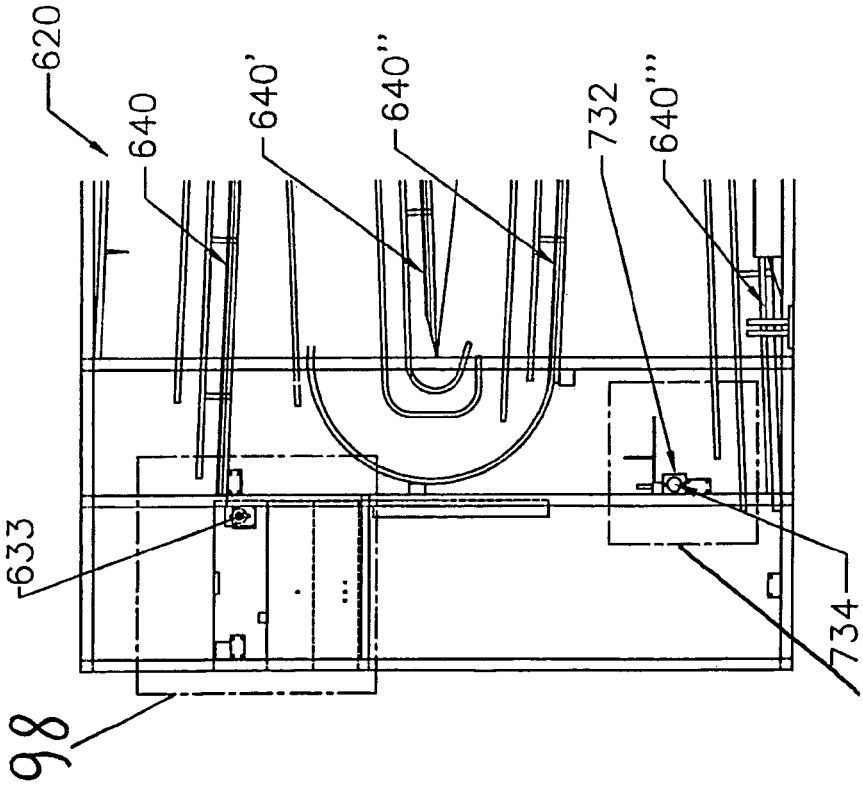



FIG 97

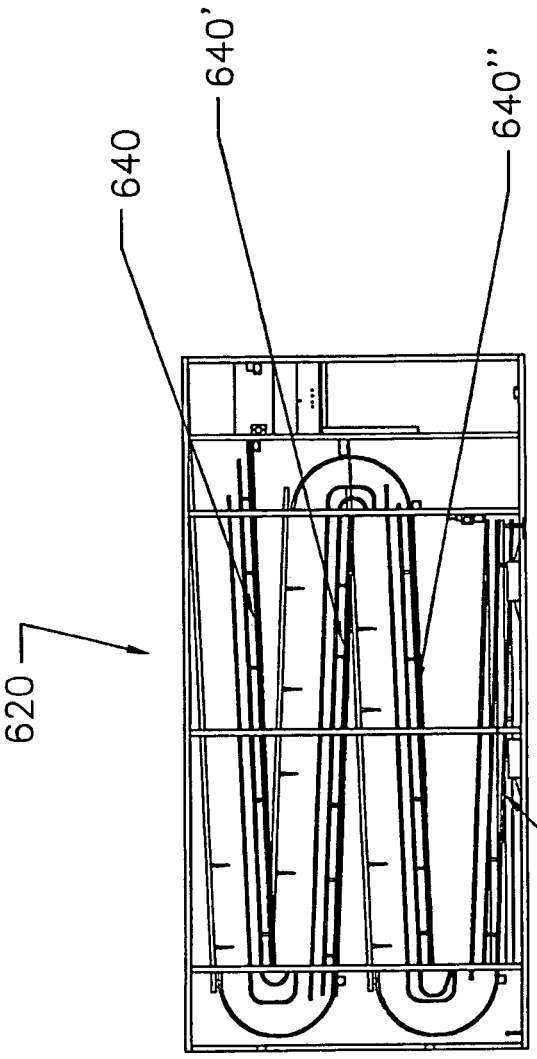



FIG 100

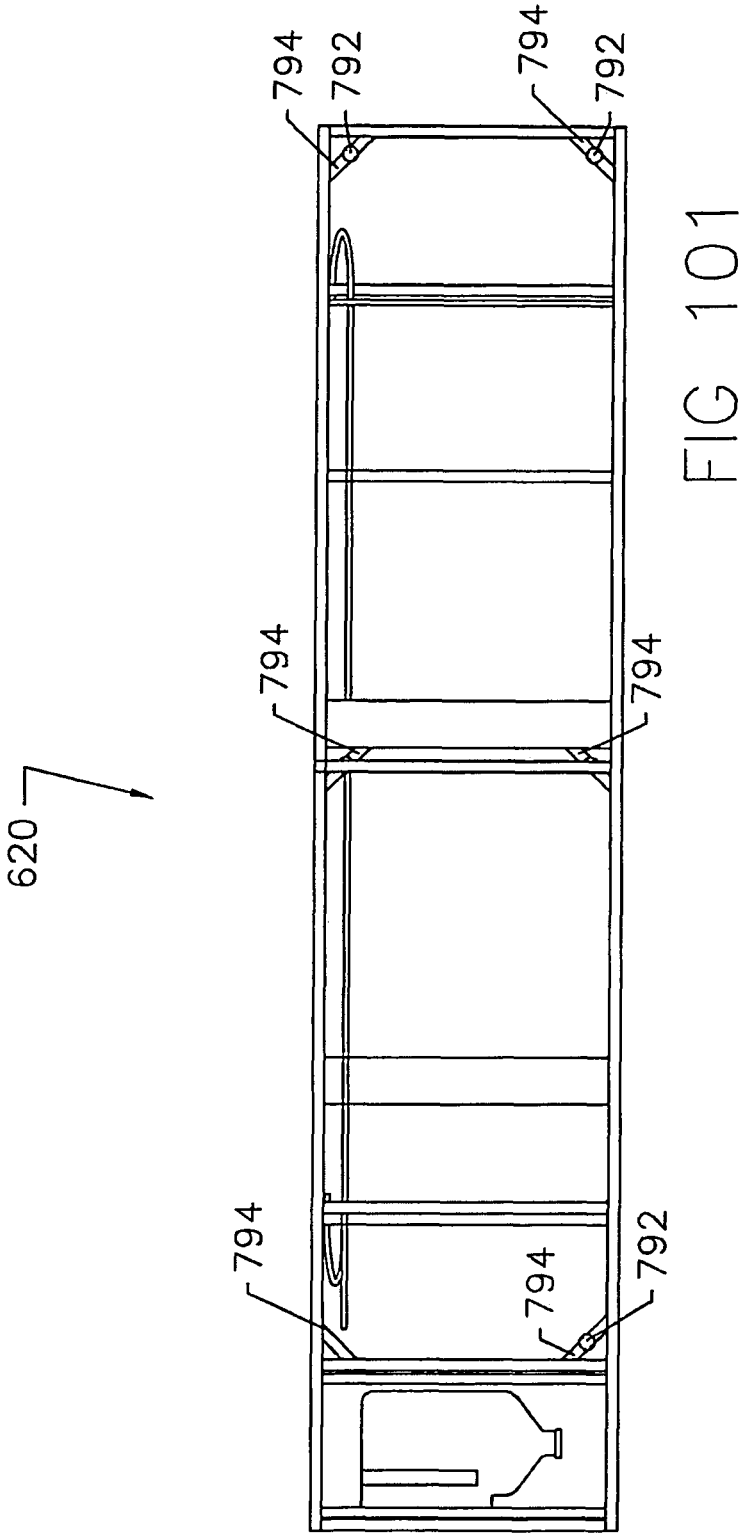



FIG 101

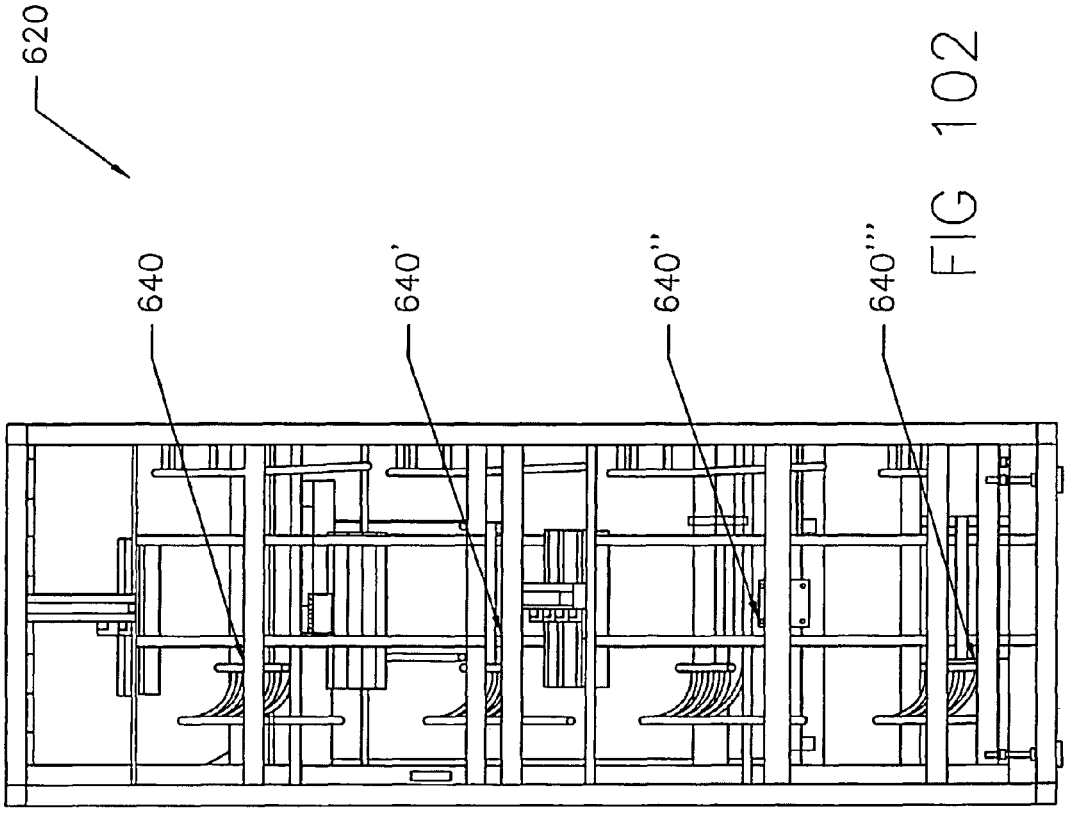



FIG 102

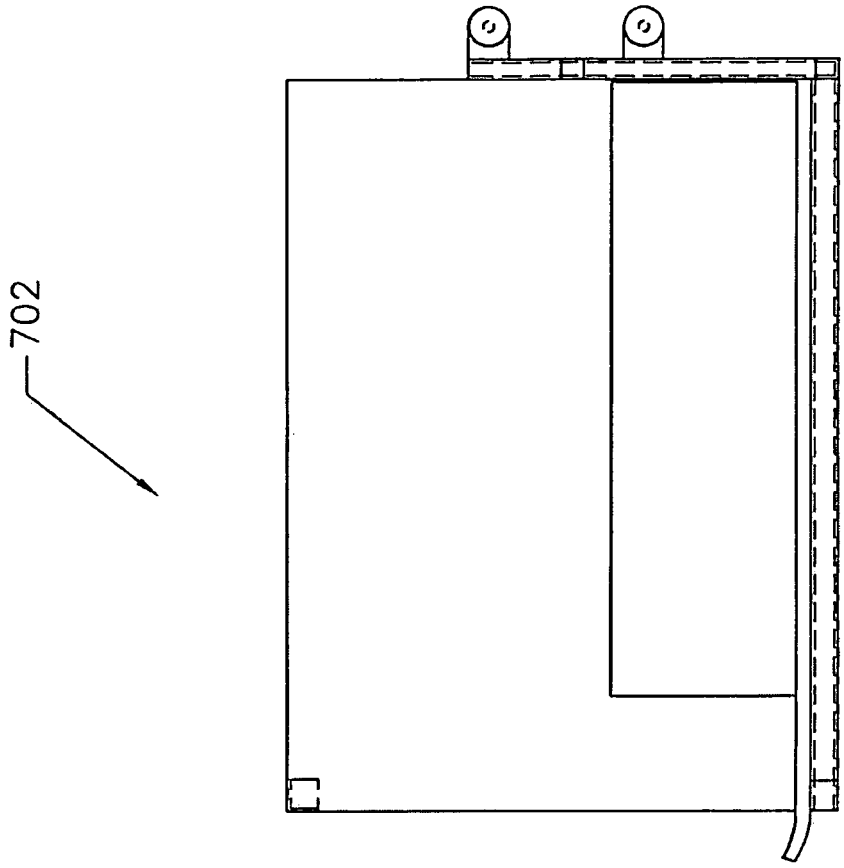



FIG 103

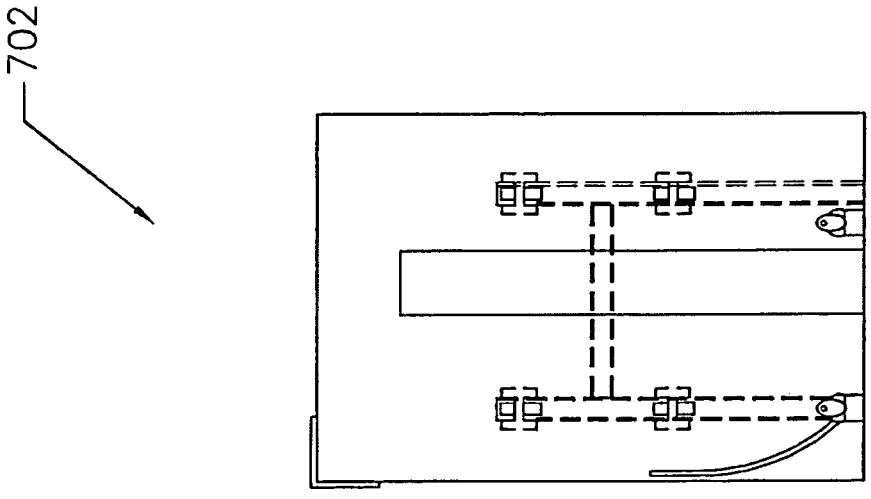



FIG 104

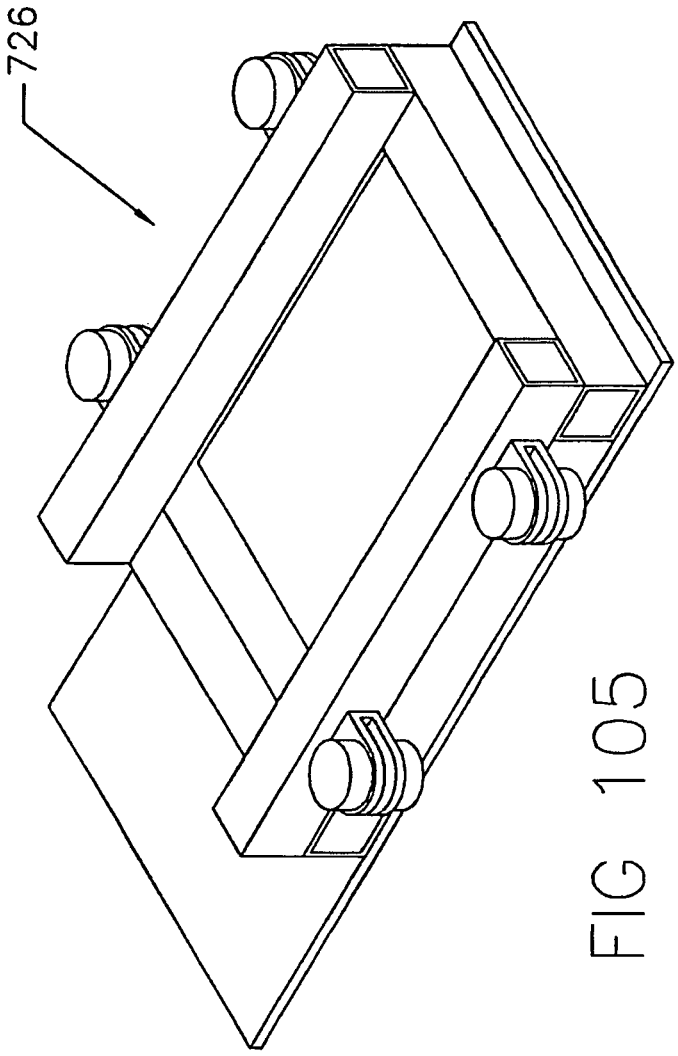



FIG 105

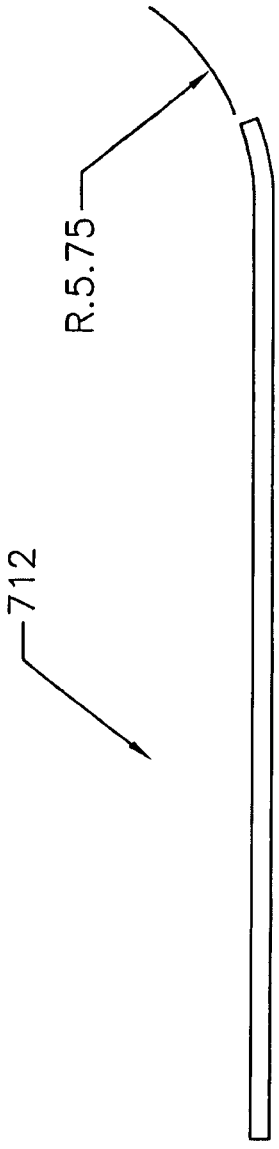



FIG 106

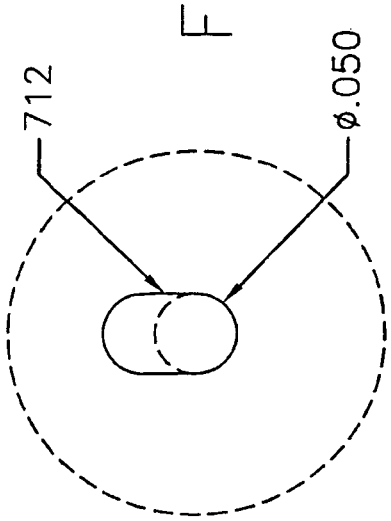



FIG 107

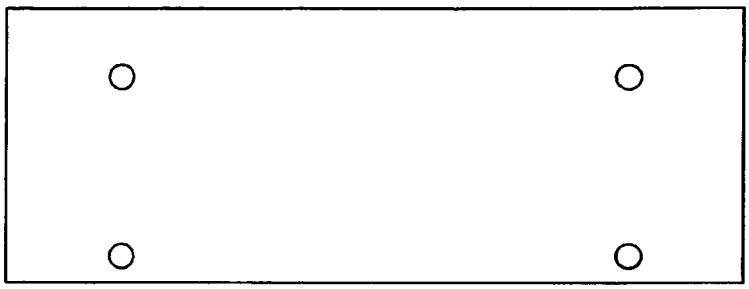


FIG 108

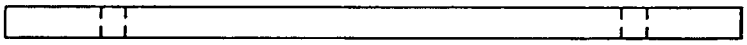


FIG 109

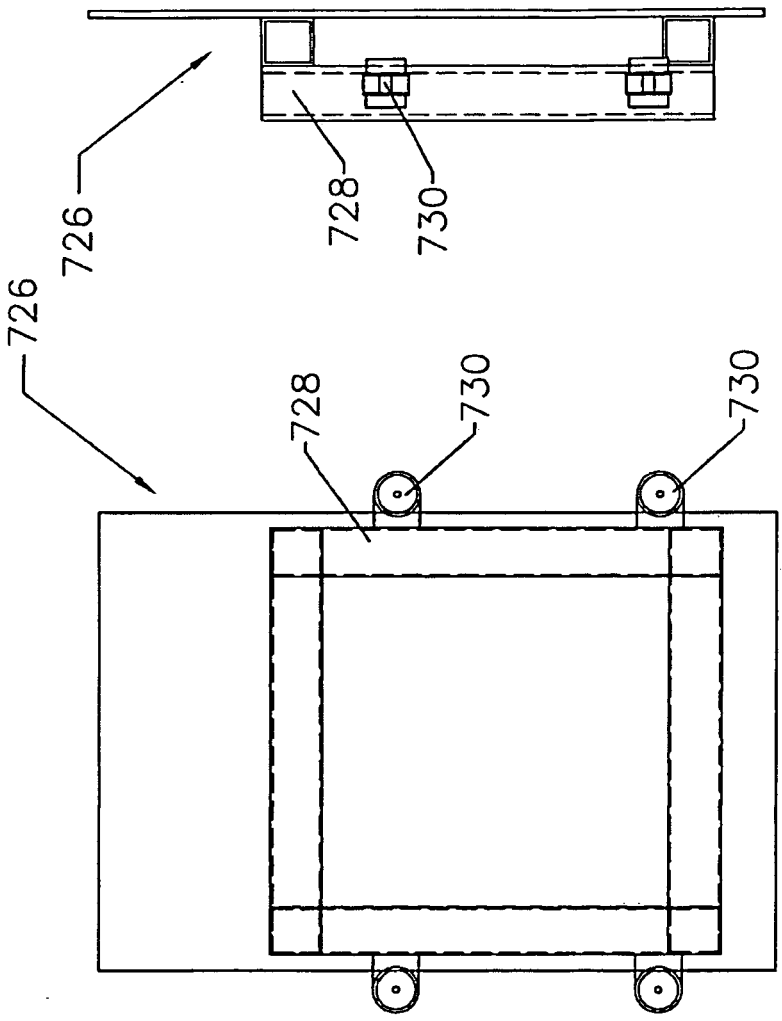



FIG 110

FIG 111

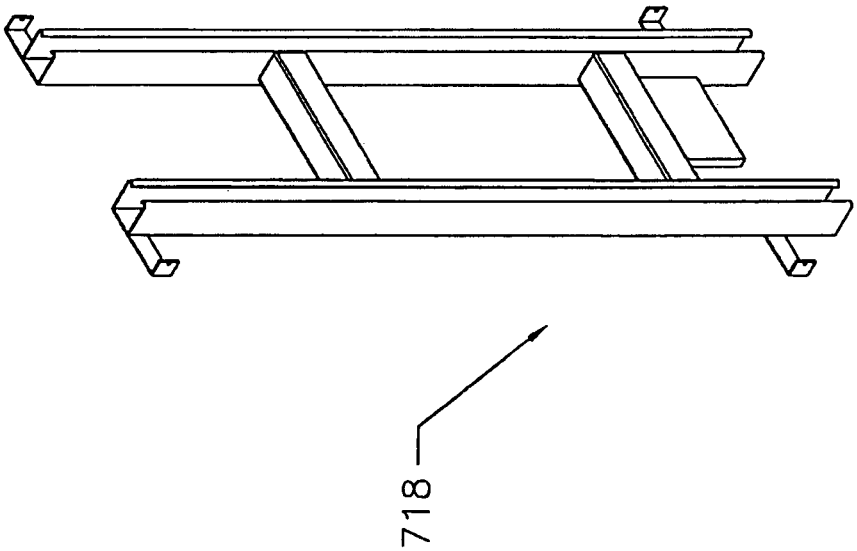



FIG 112

FIG 114

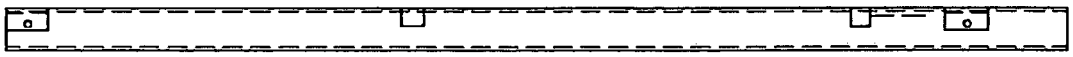
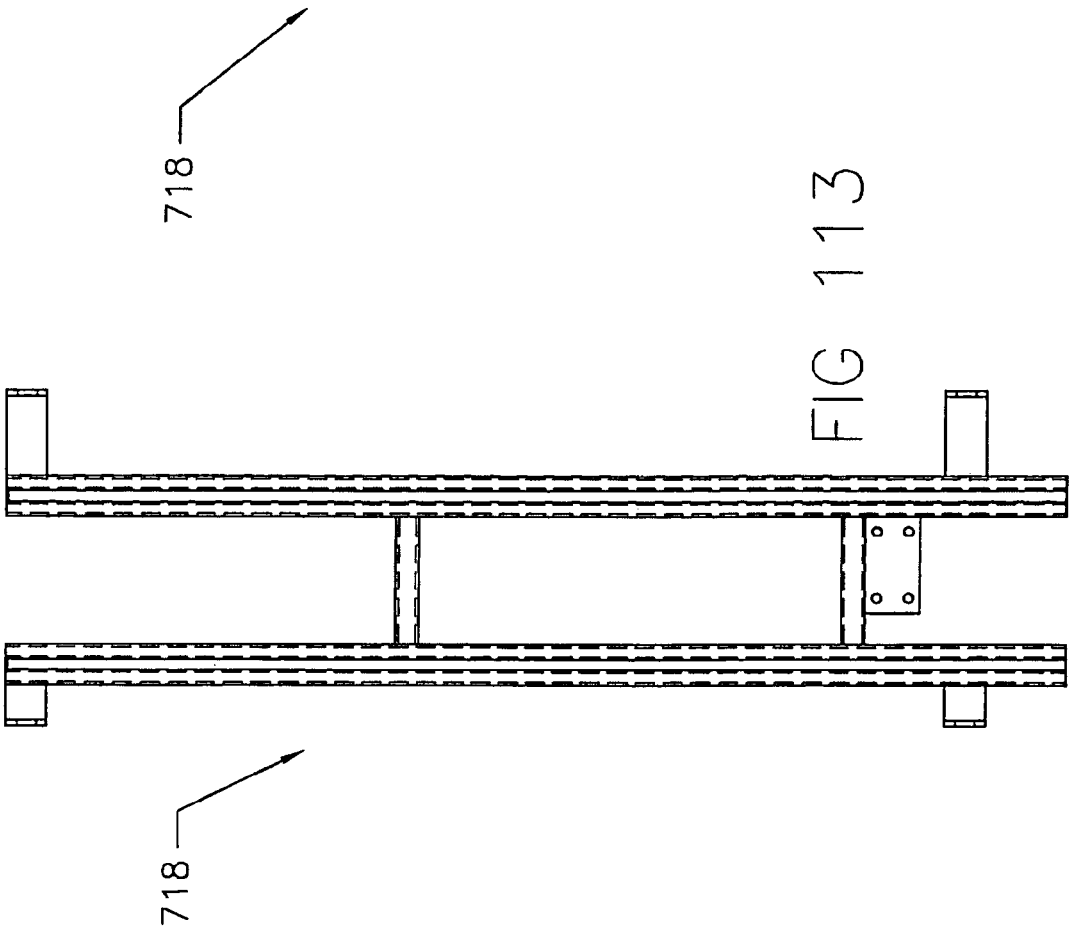


FIG 113



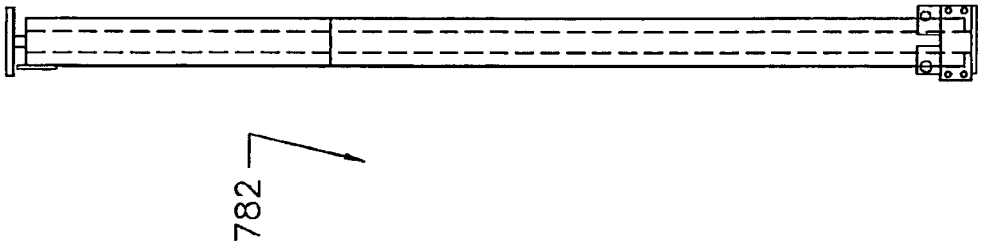



FIG 116

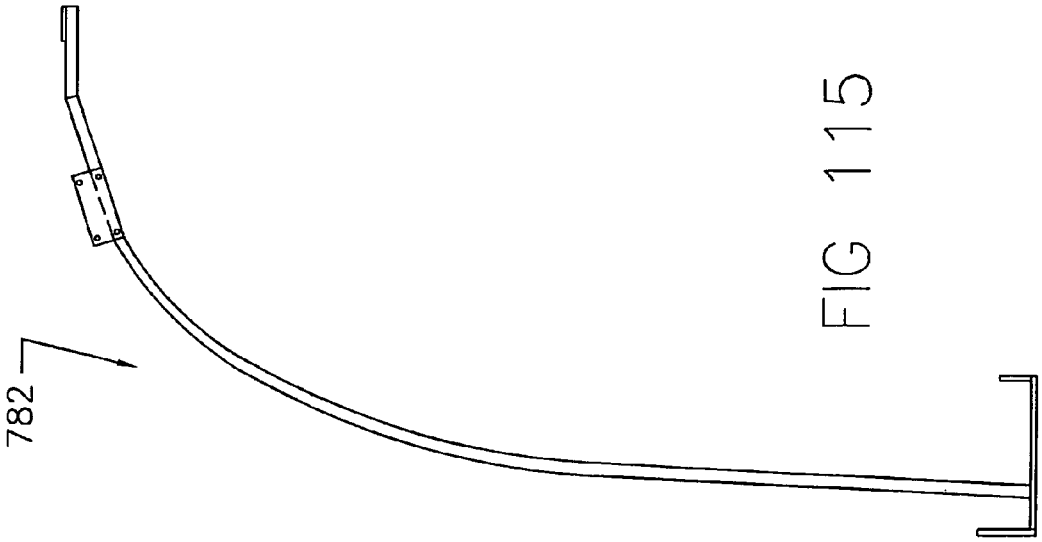



FIG 115

FIG 118

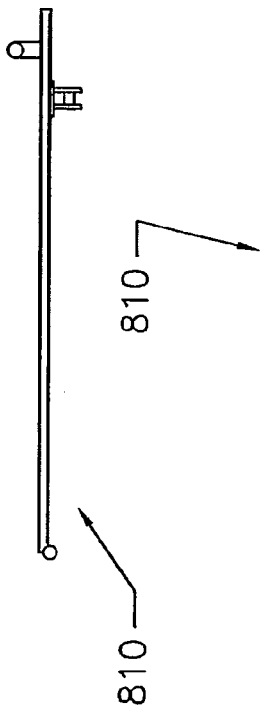
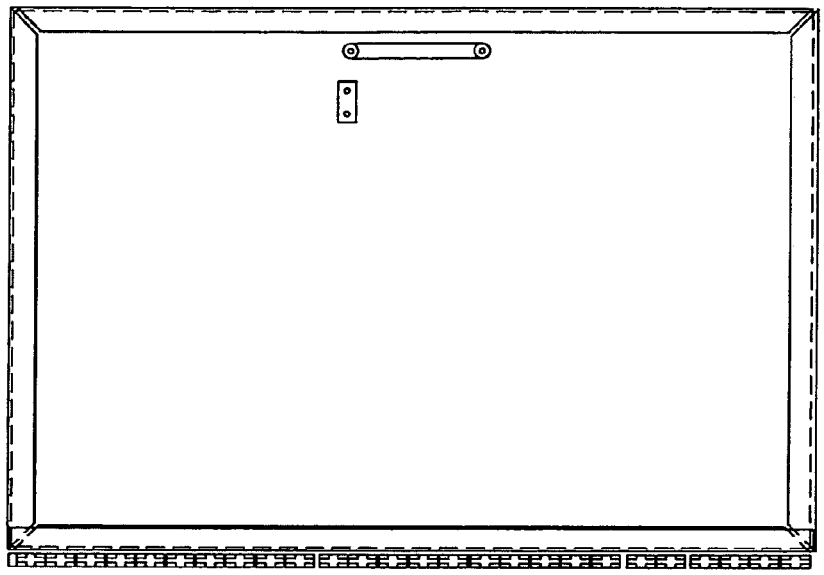



FIG 117



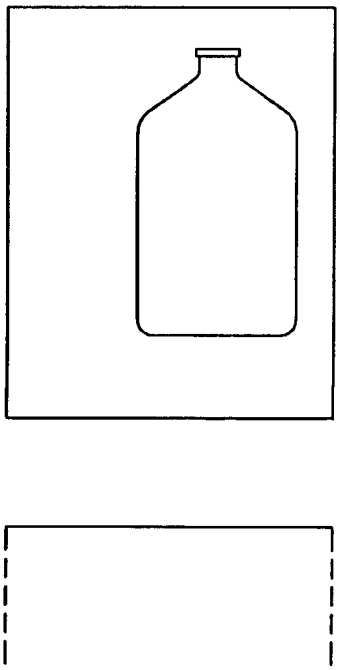


FIG 119

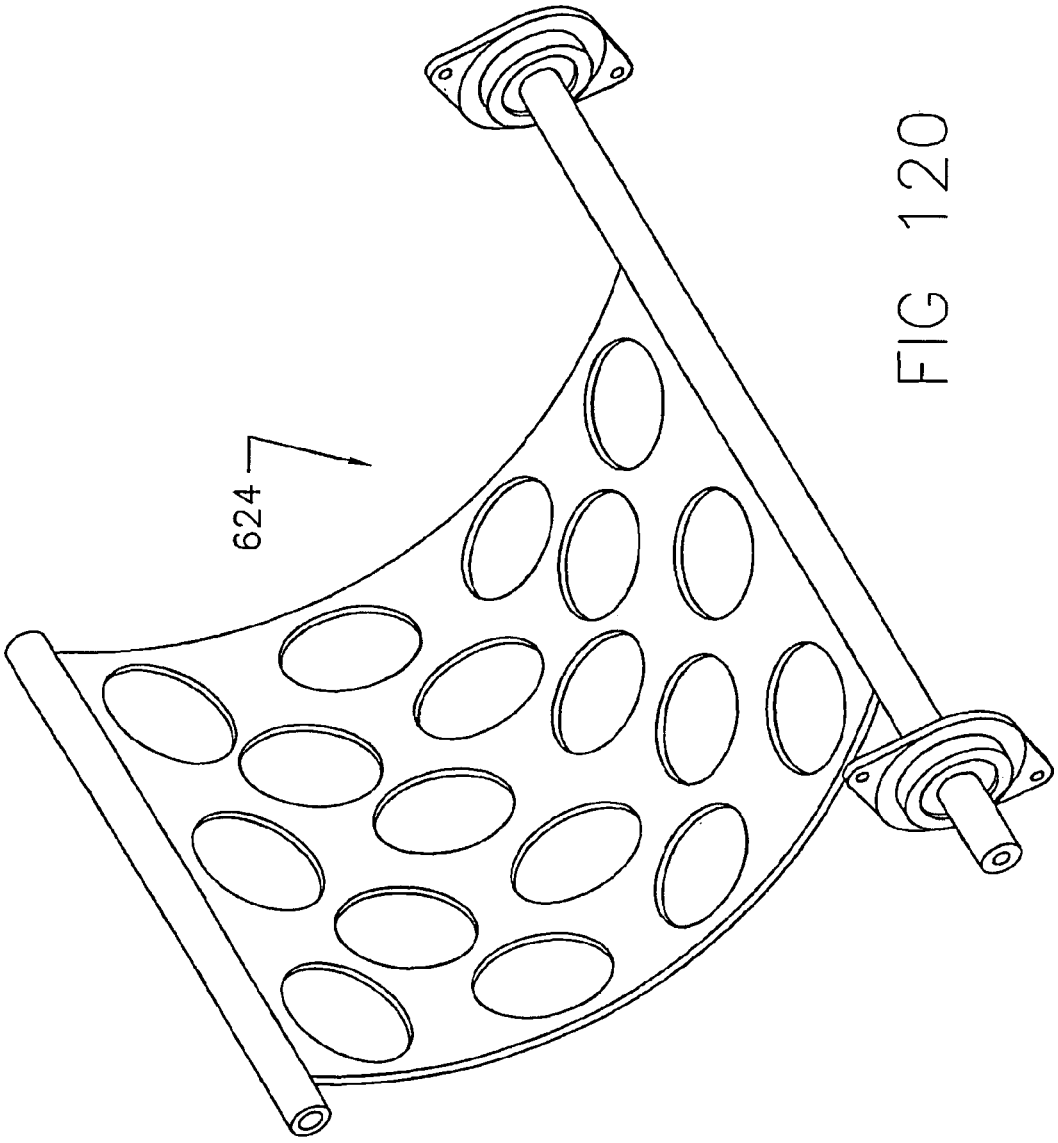



FIG 120

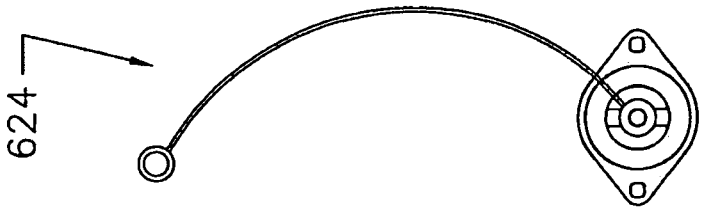



FIG 122

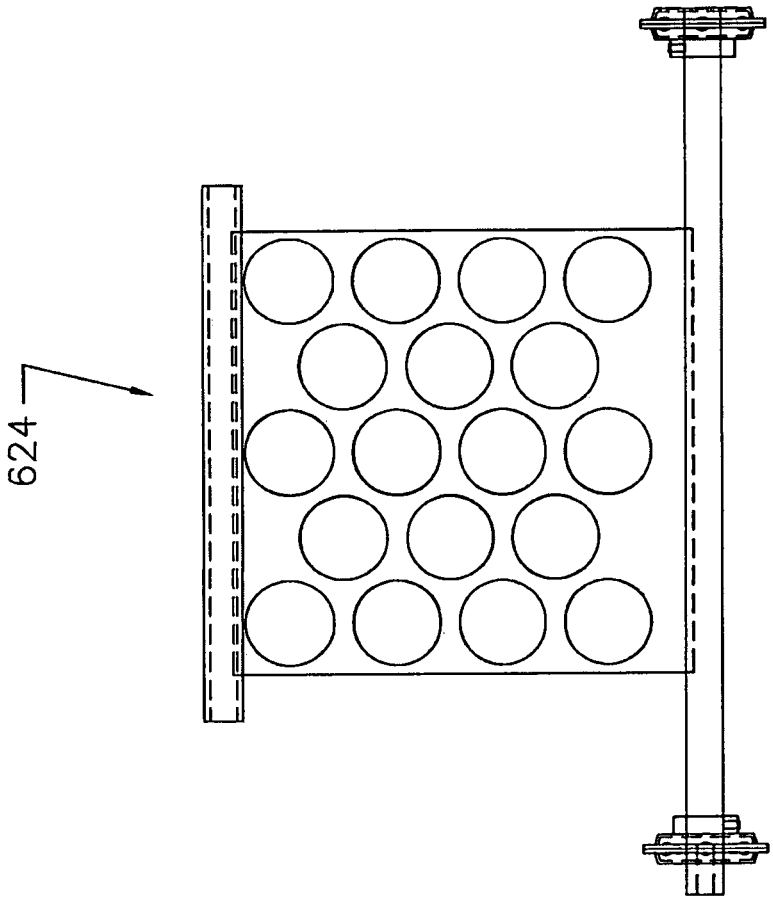
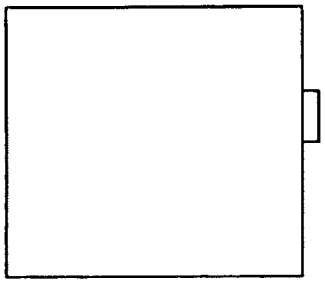



FIG 121

FIG 126



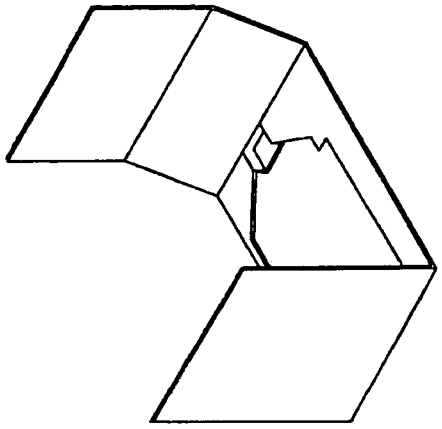


FIG 124

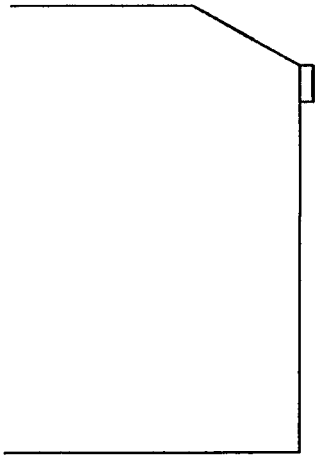


FIG 125

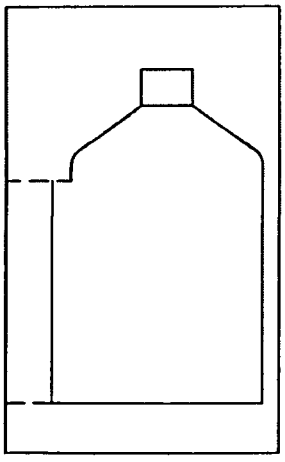


FIG 123

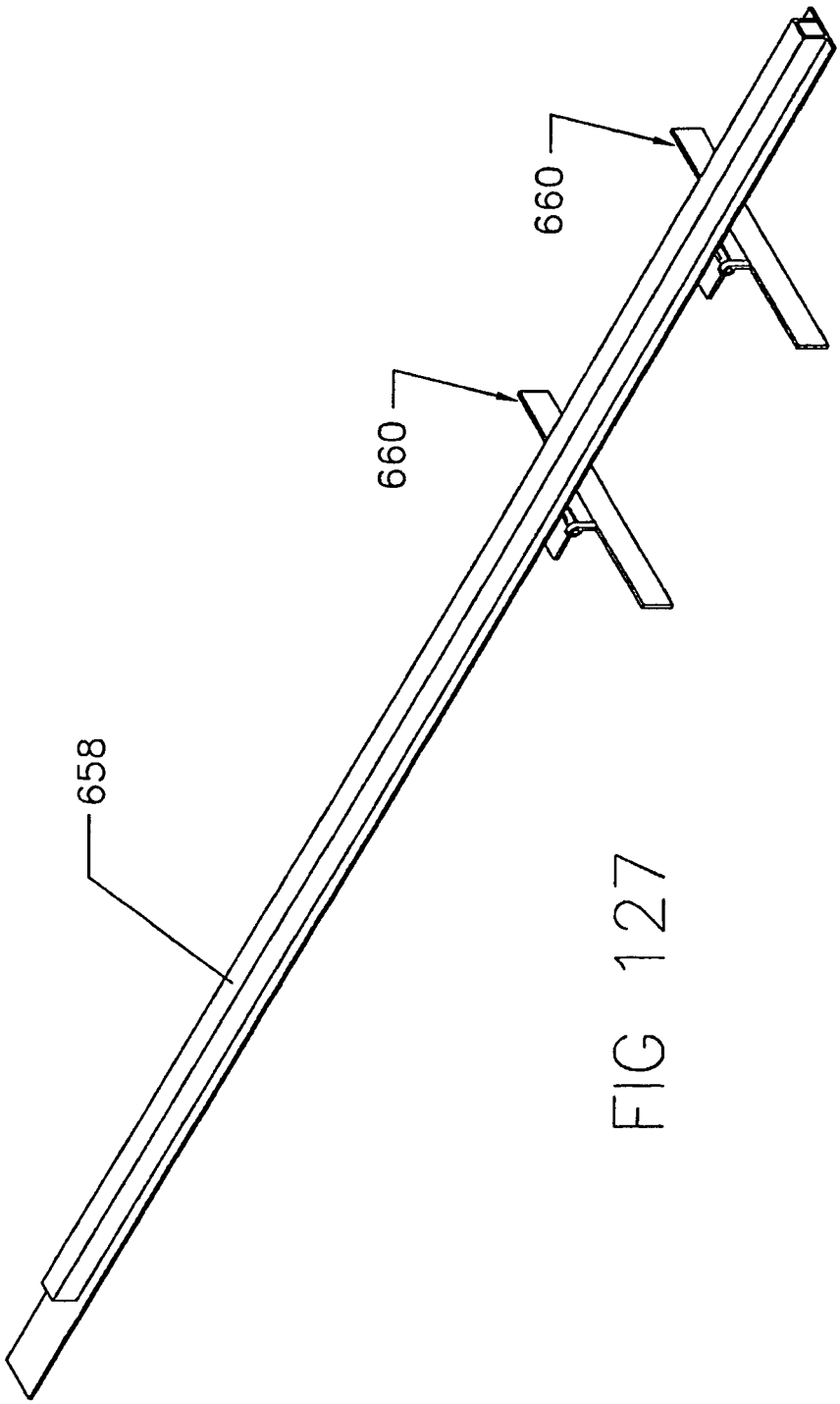



FIG 127

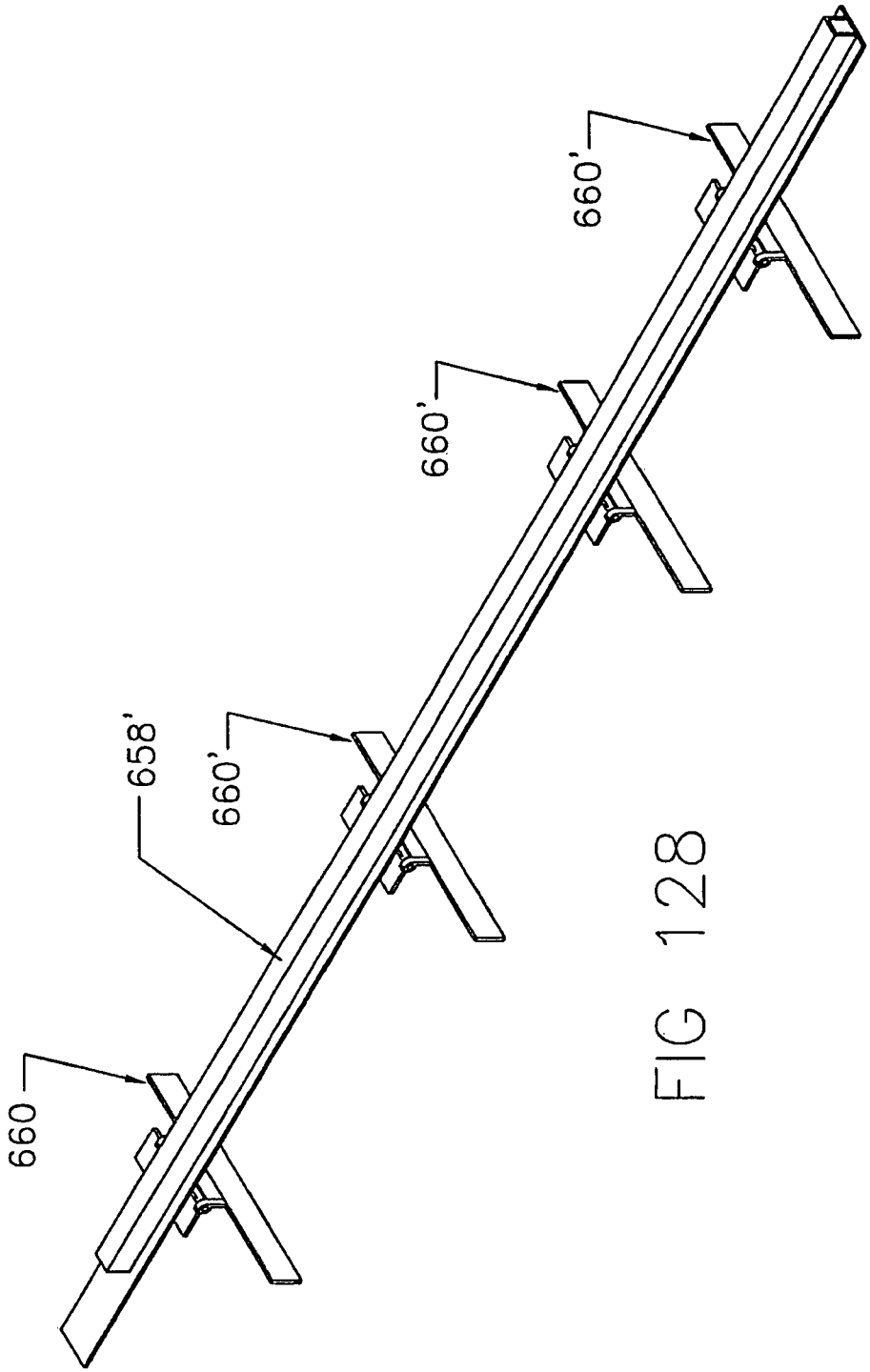



FIG 128

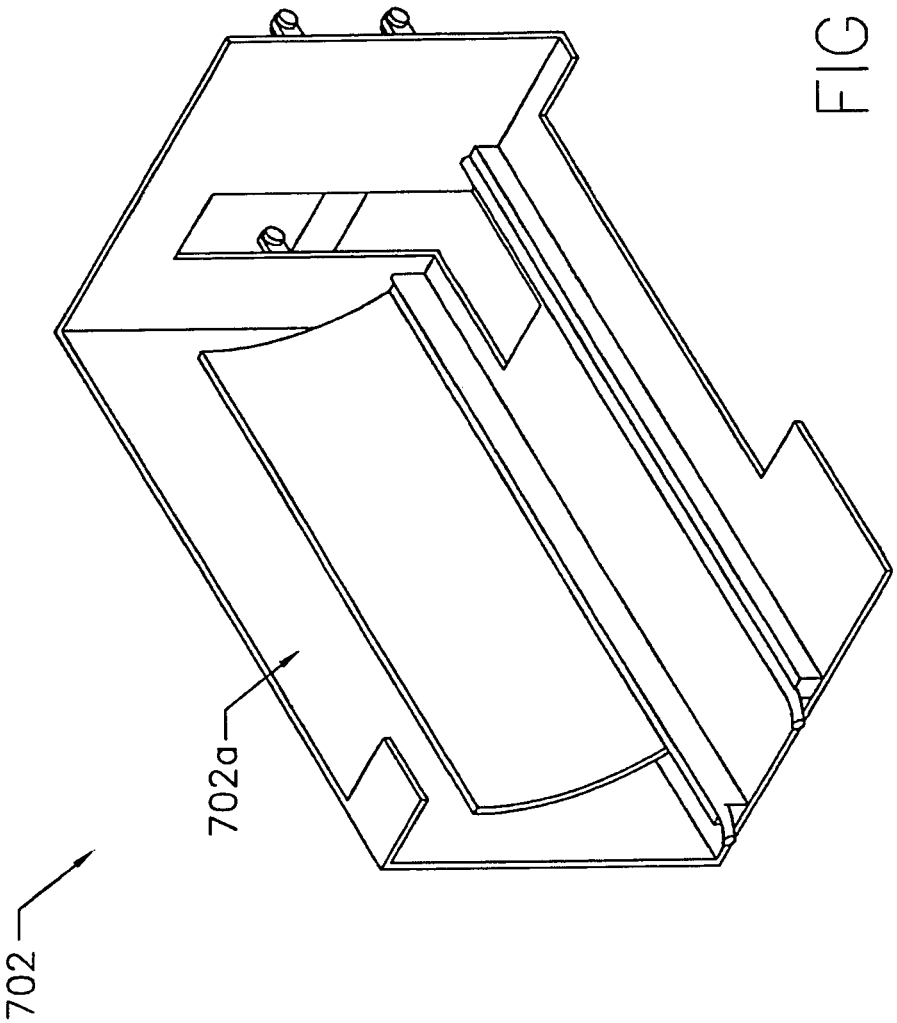



FIG 129

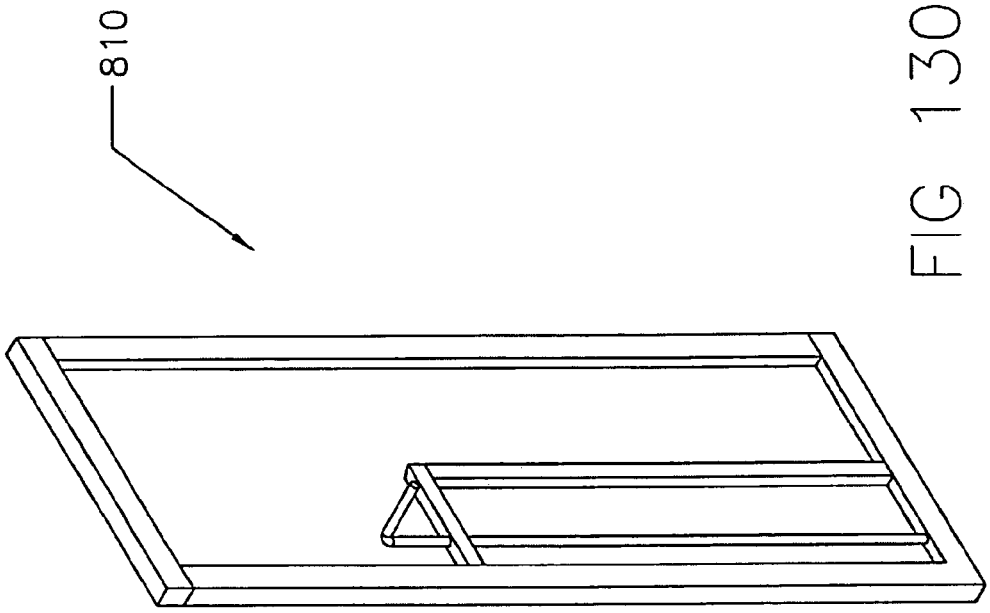
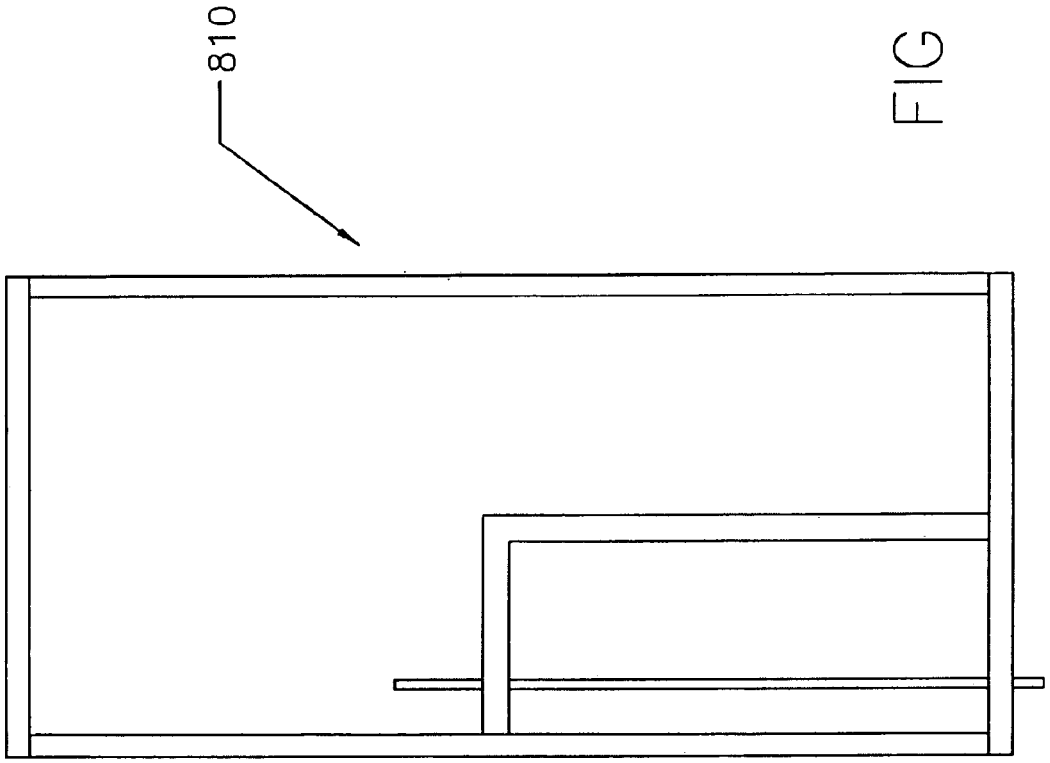



FIG 130

FIG 131



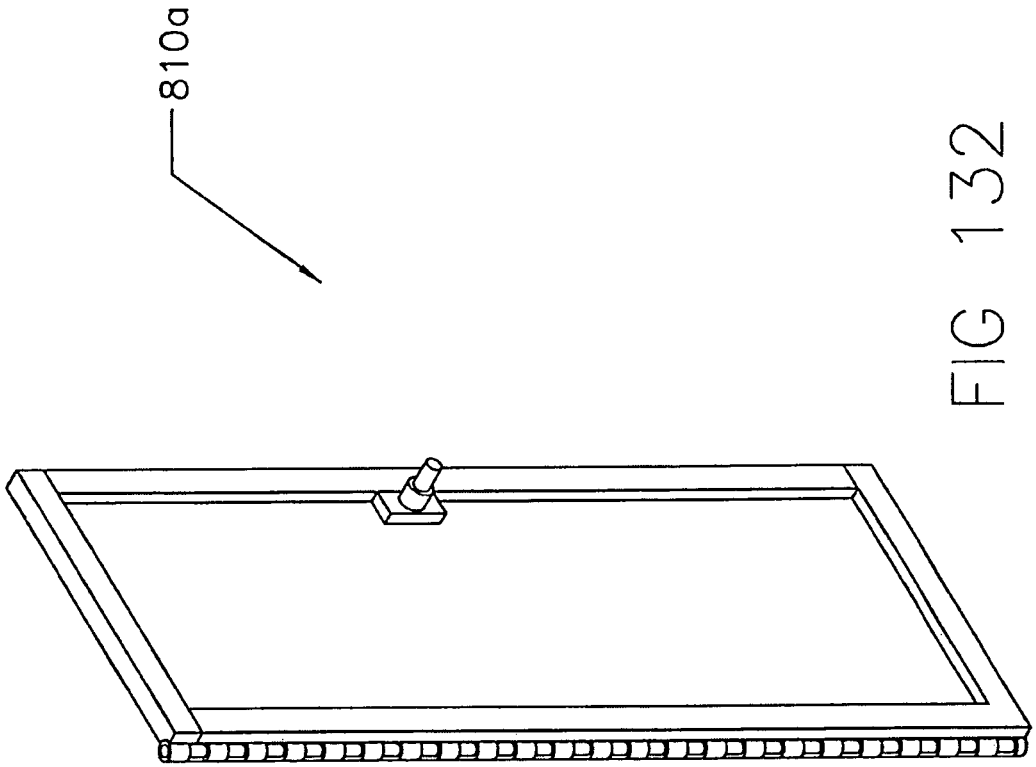
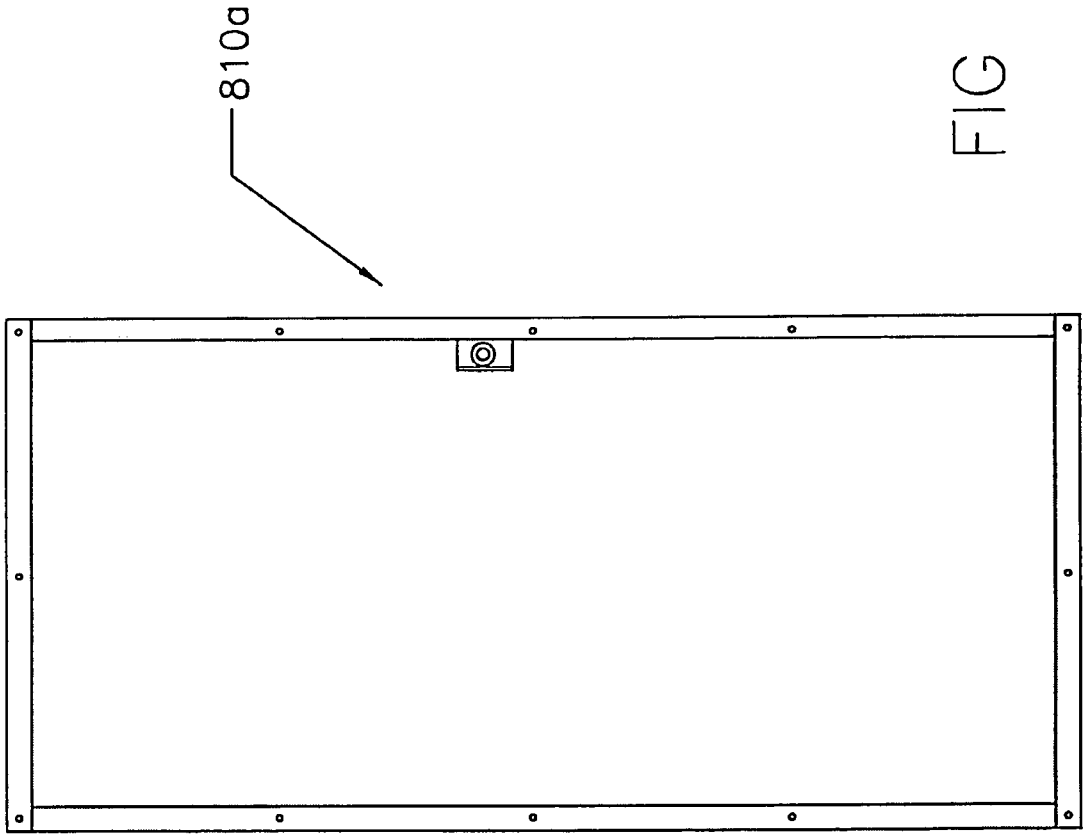



FIG 132

FIG 133



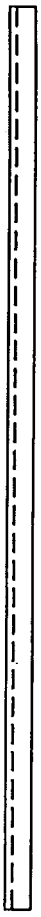


FIG 135

FIG 134

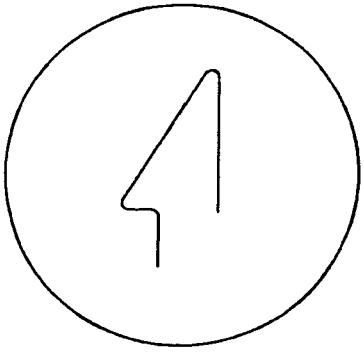


FIG 136

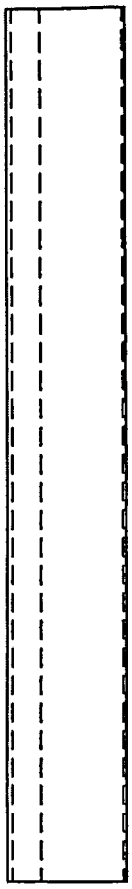


FIG 138

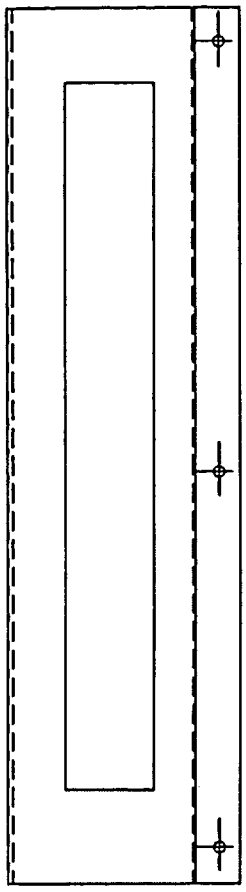


FIG 137

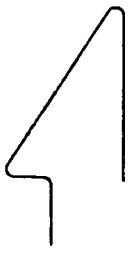


FIG 139

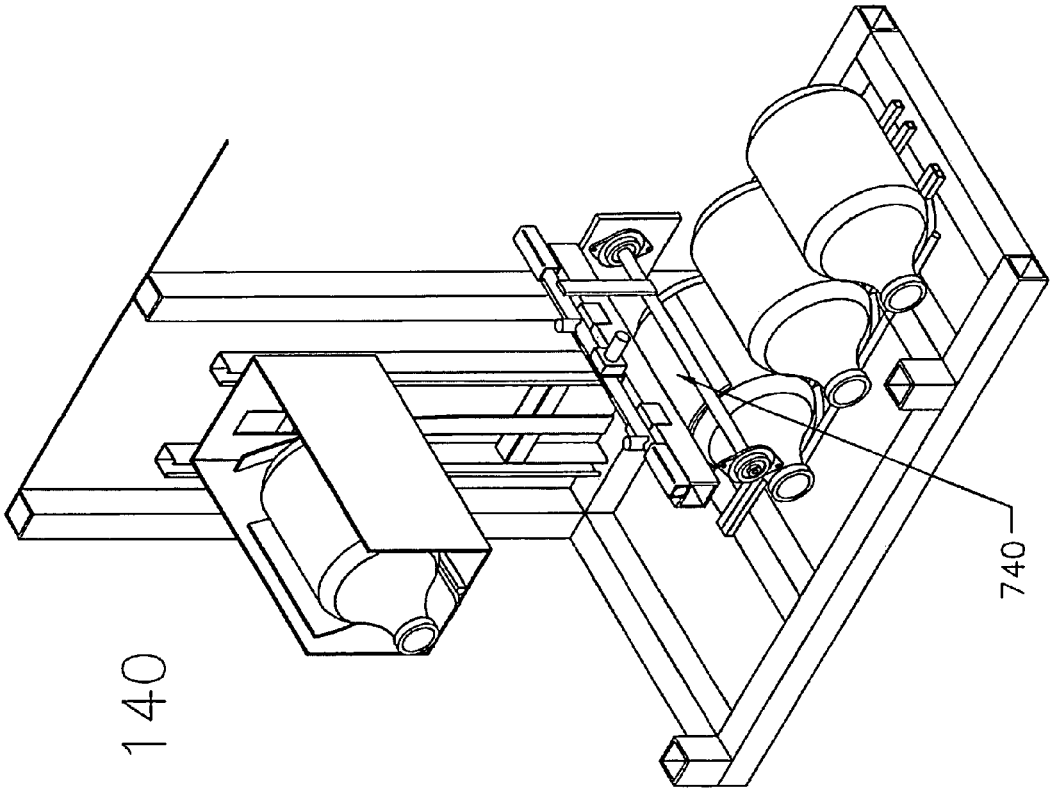
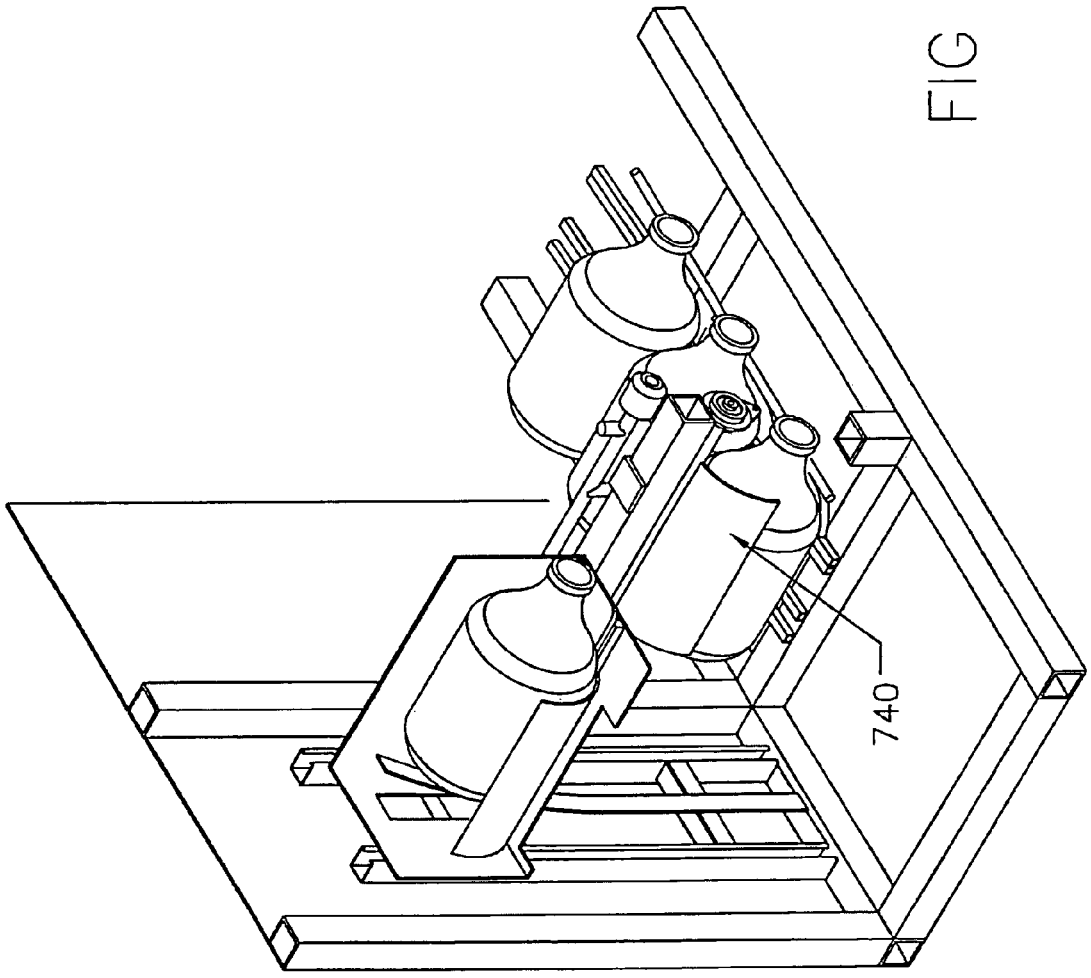



FIG 140

FIG 141



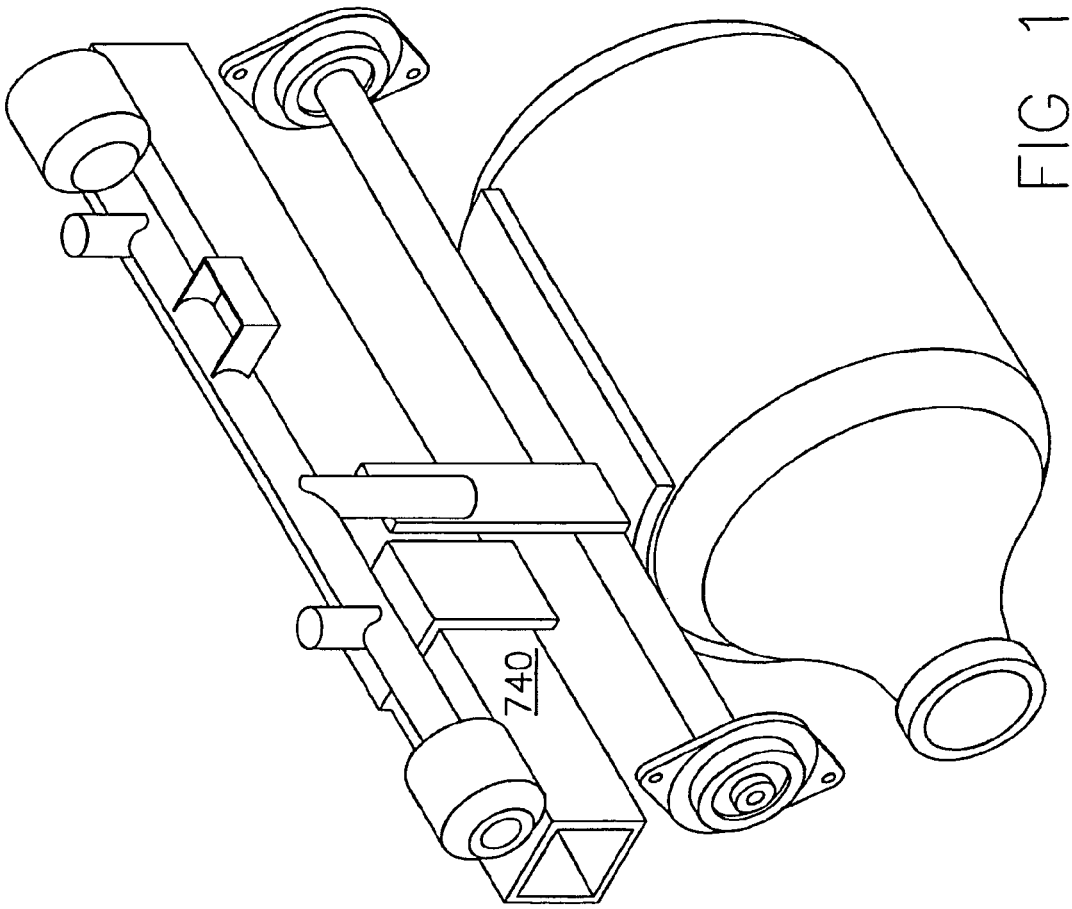



FIG 142

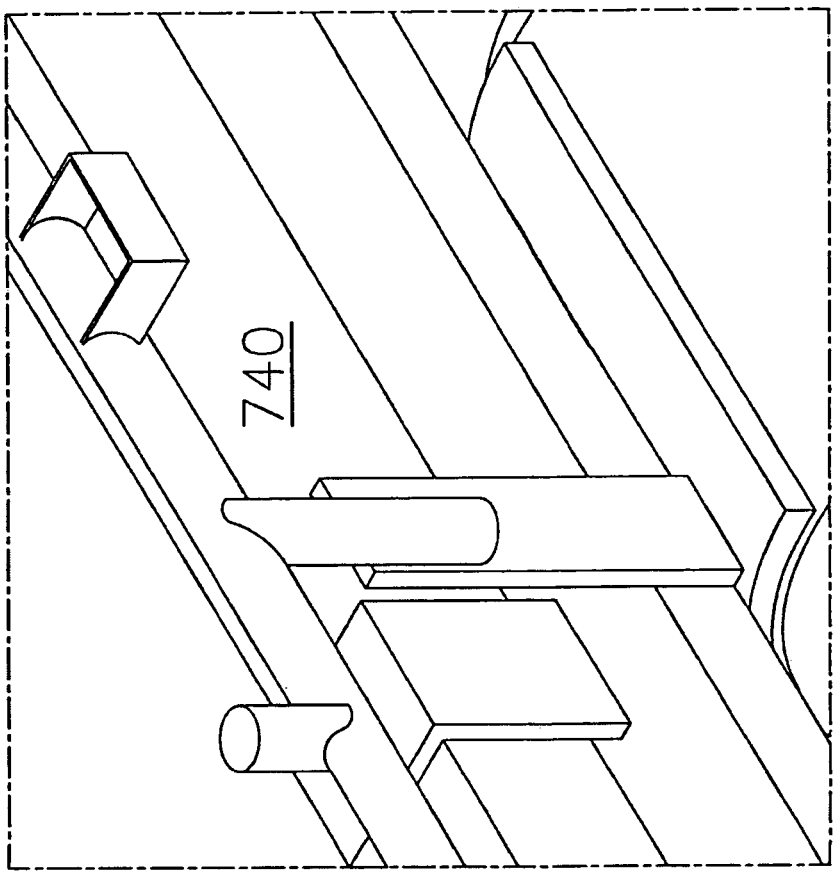



FIG 143

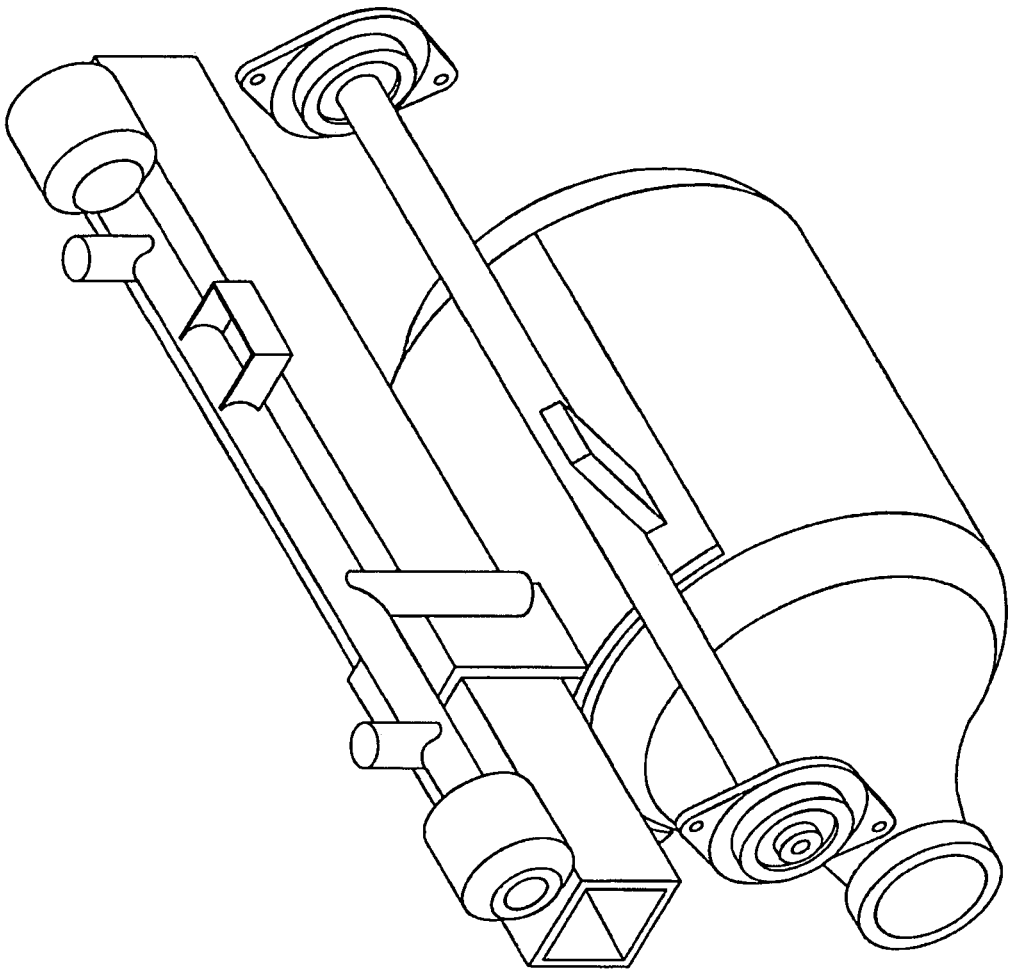


FIG 144

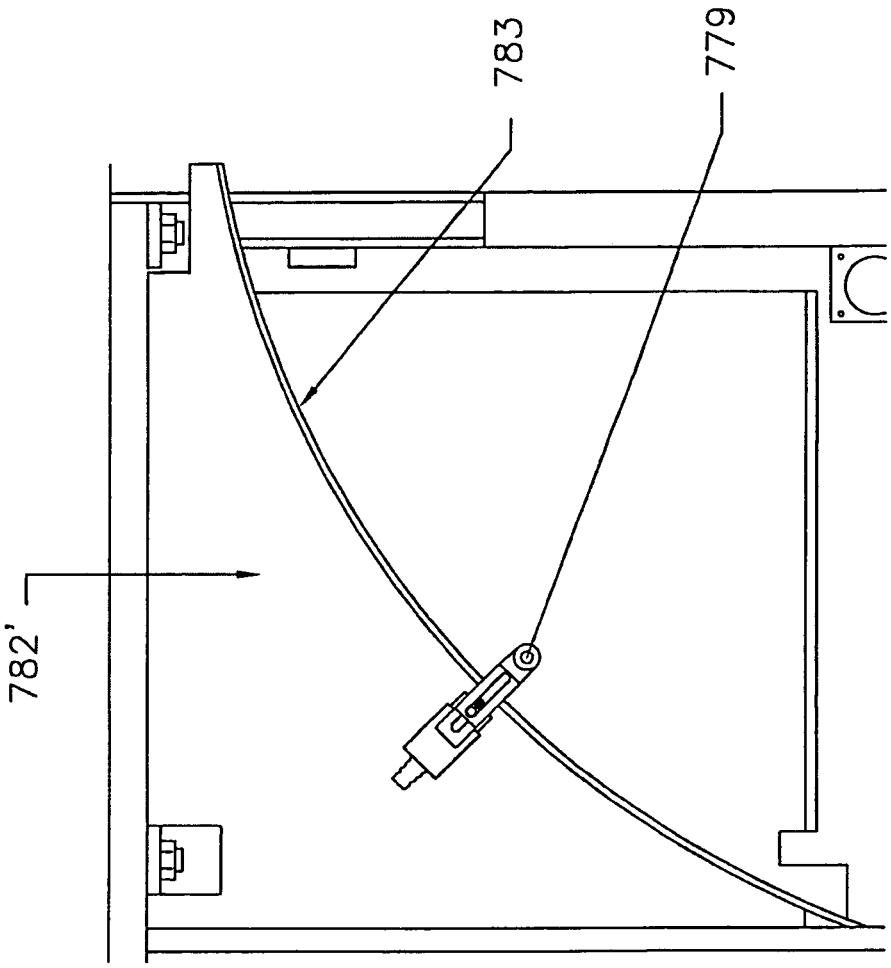



FIG 145

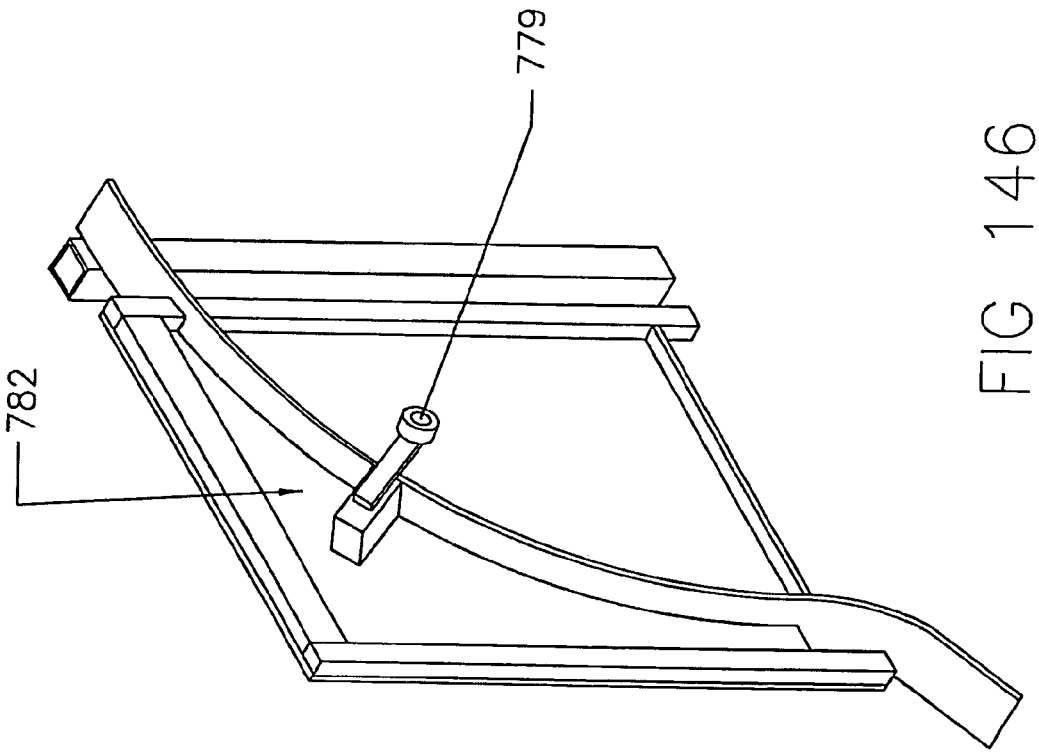



FIG 146

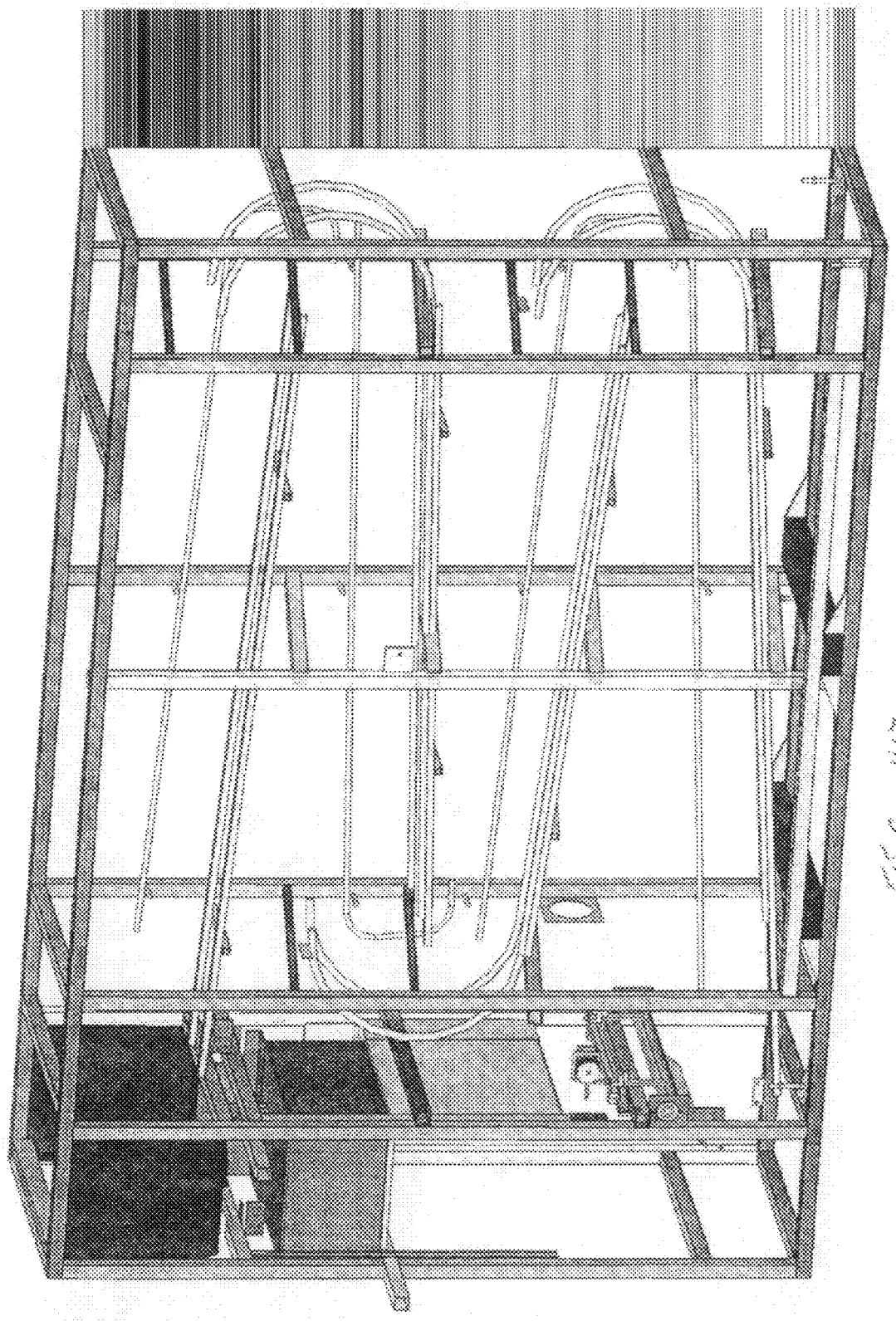


FIG. 147

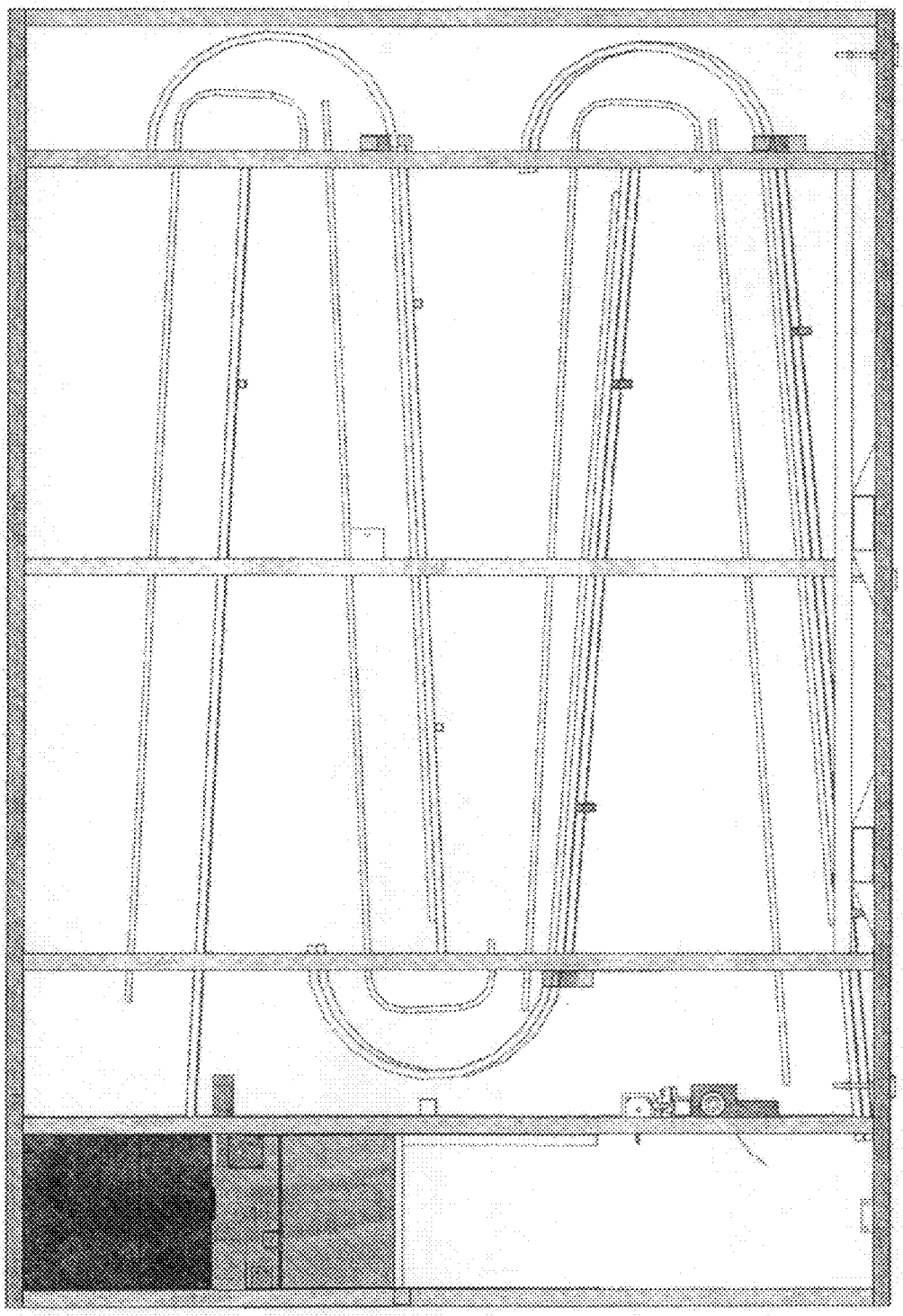


FIG. 14P

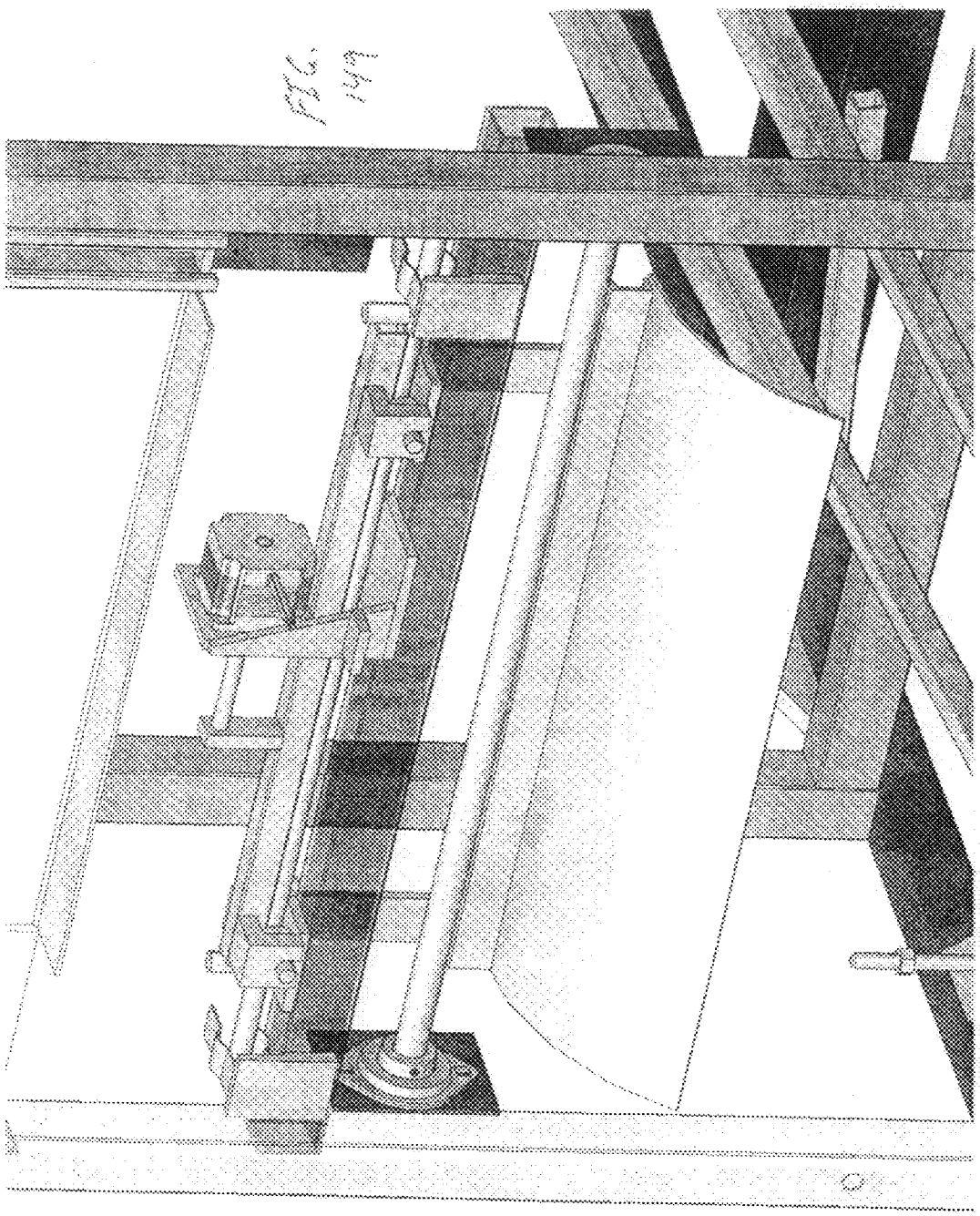
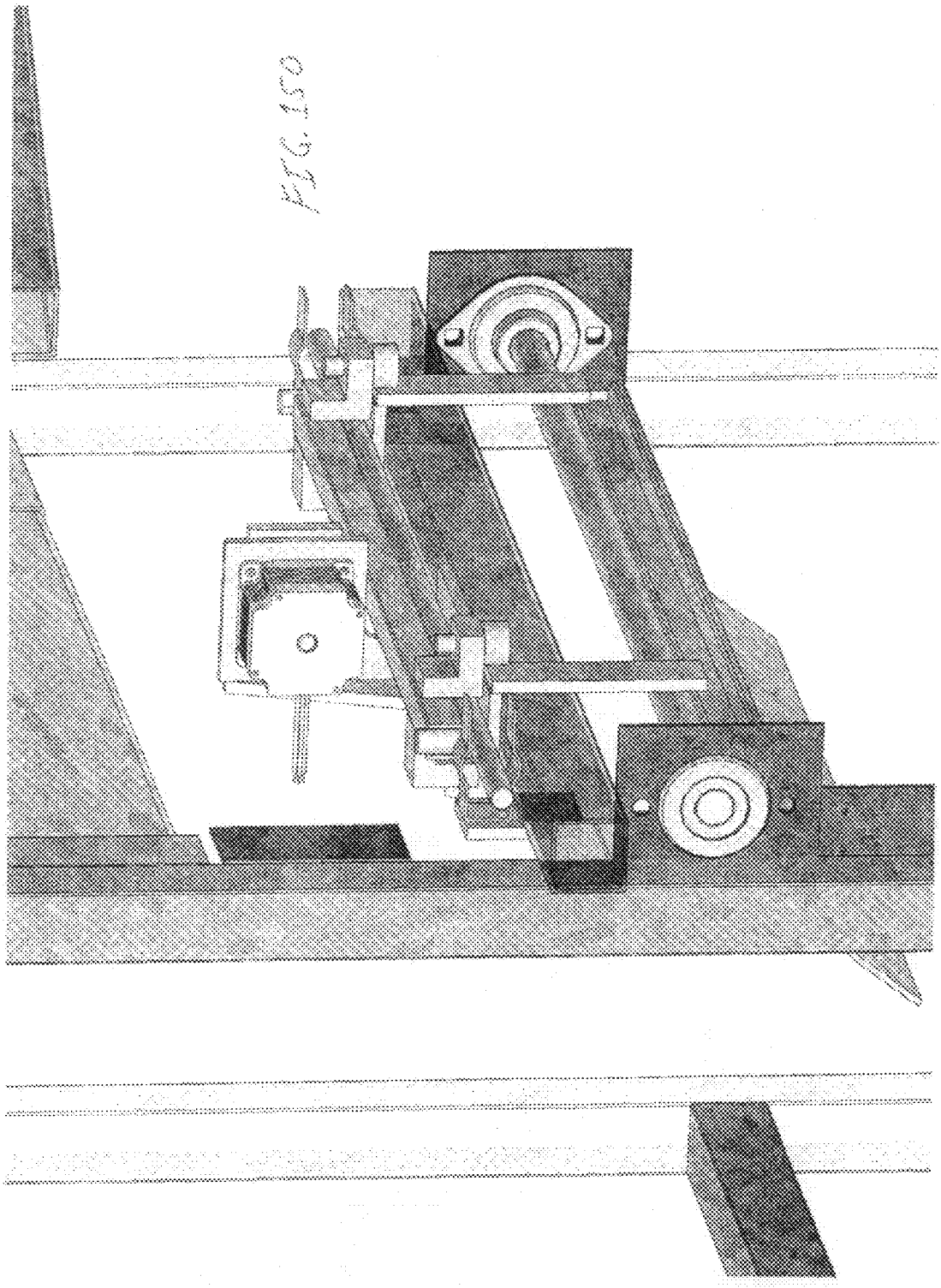


FIG. 150



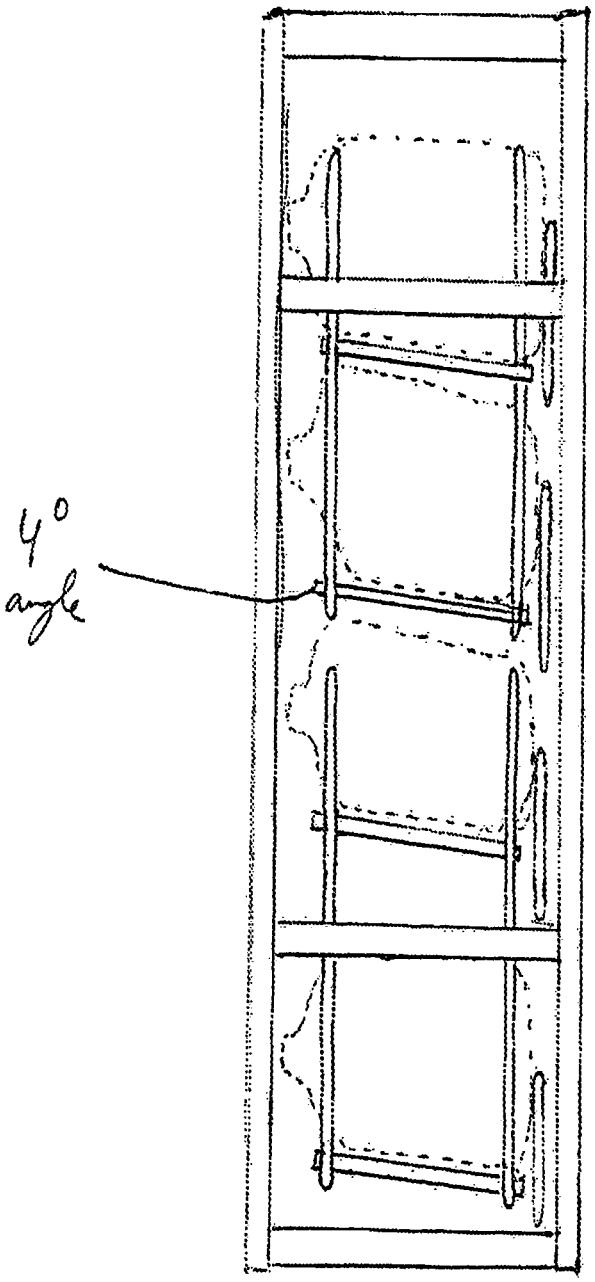



FIG 151

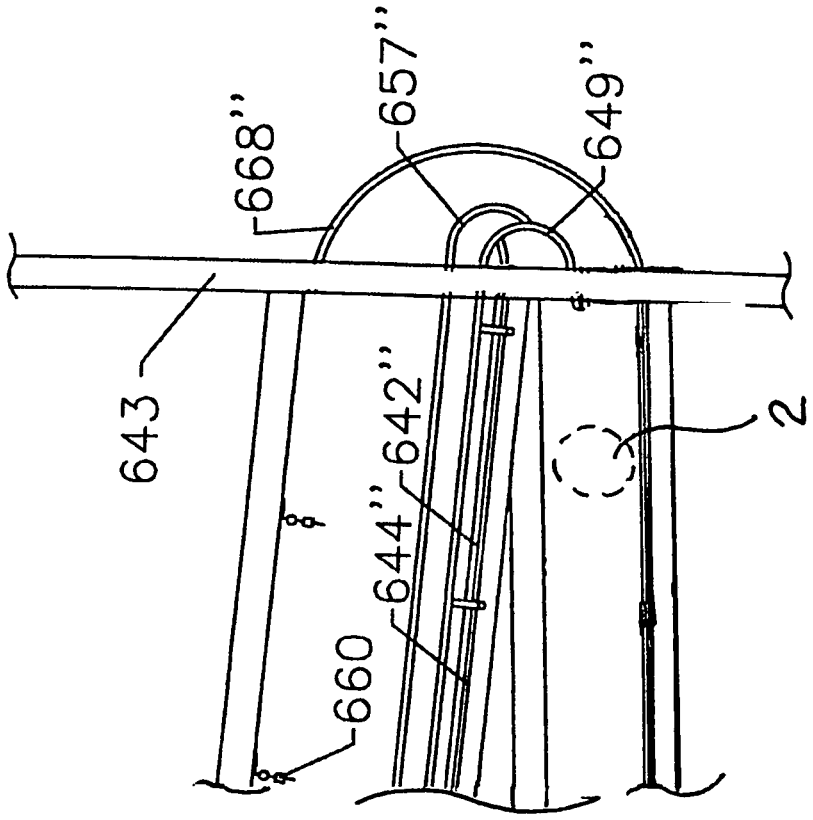



FIG. 152

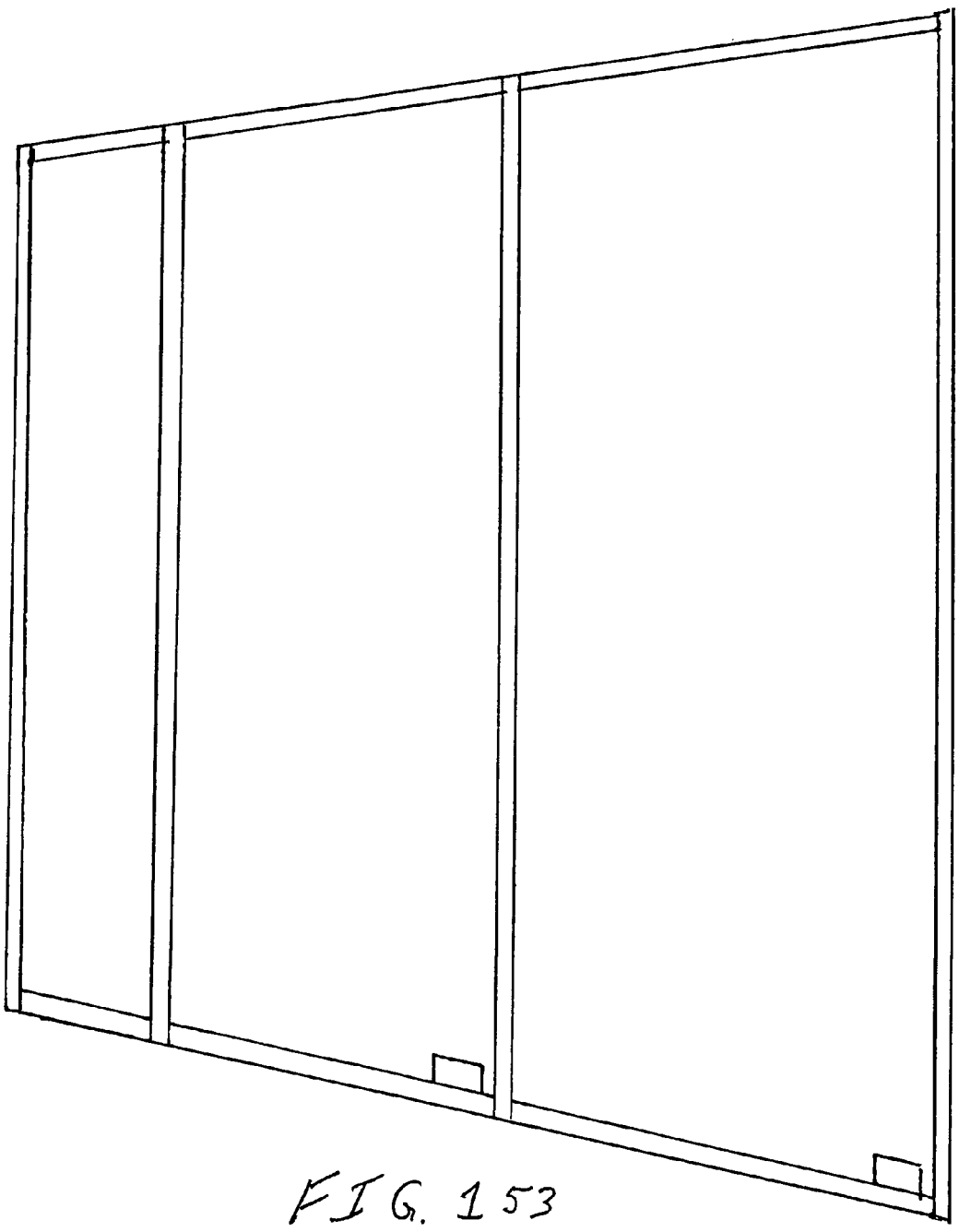


FIG. 153

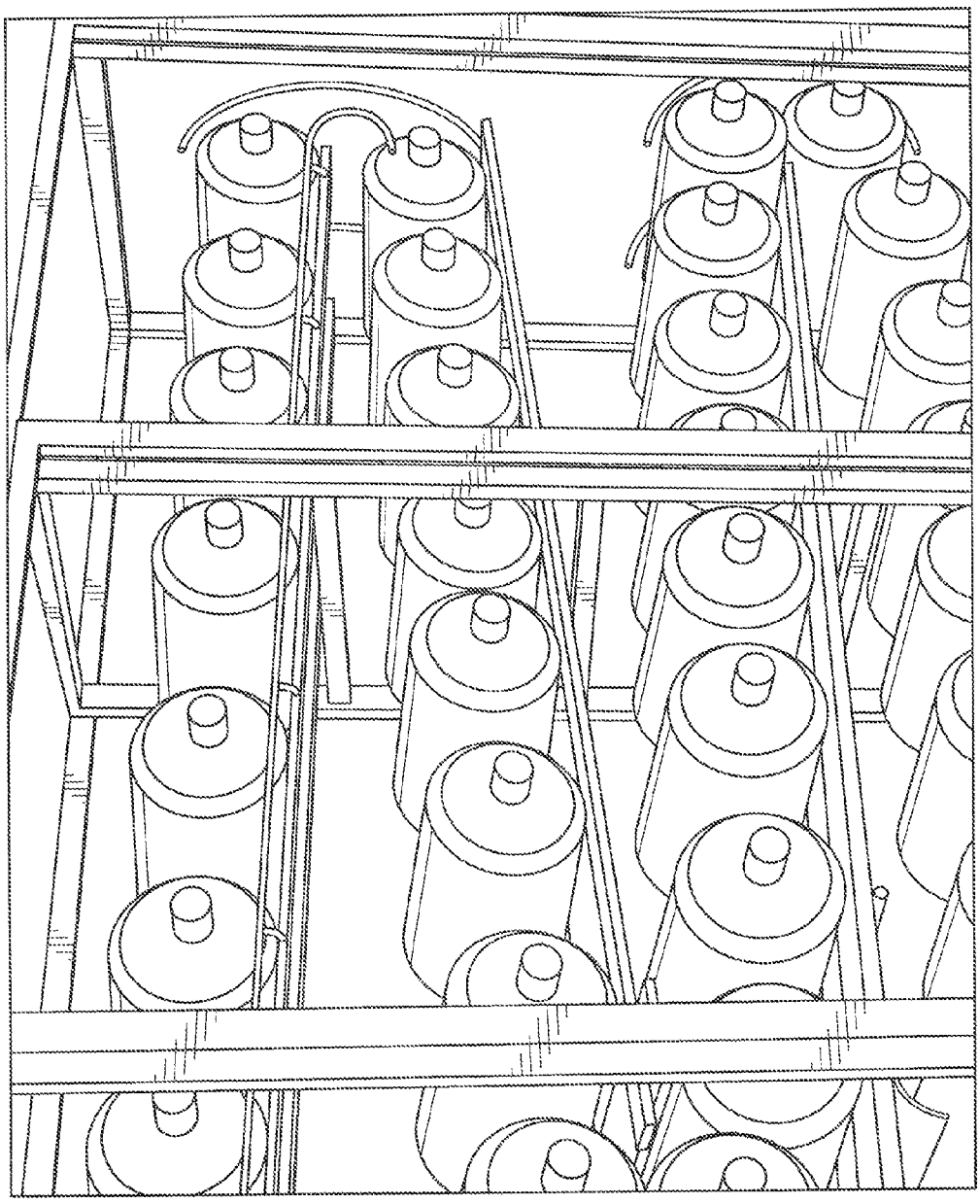


FIG. 154

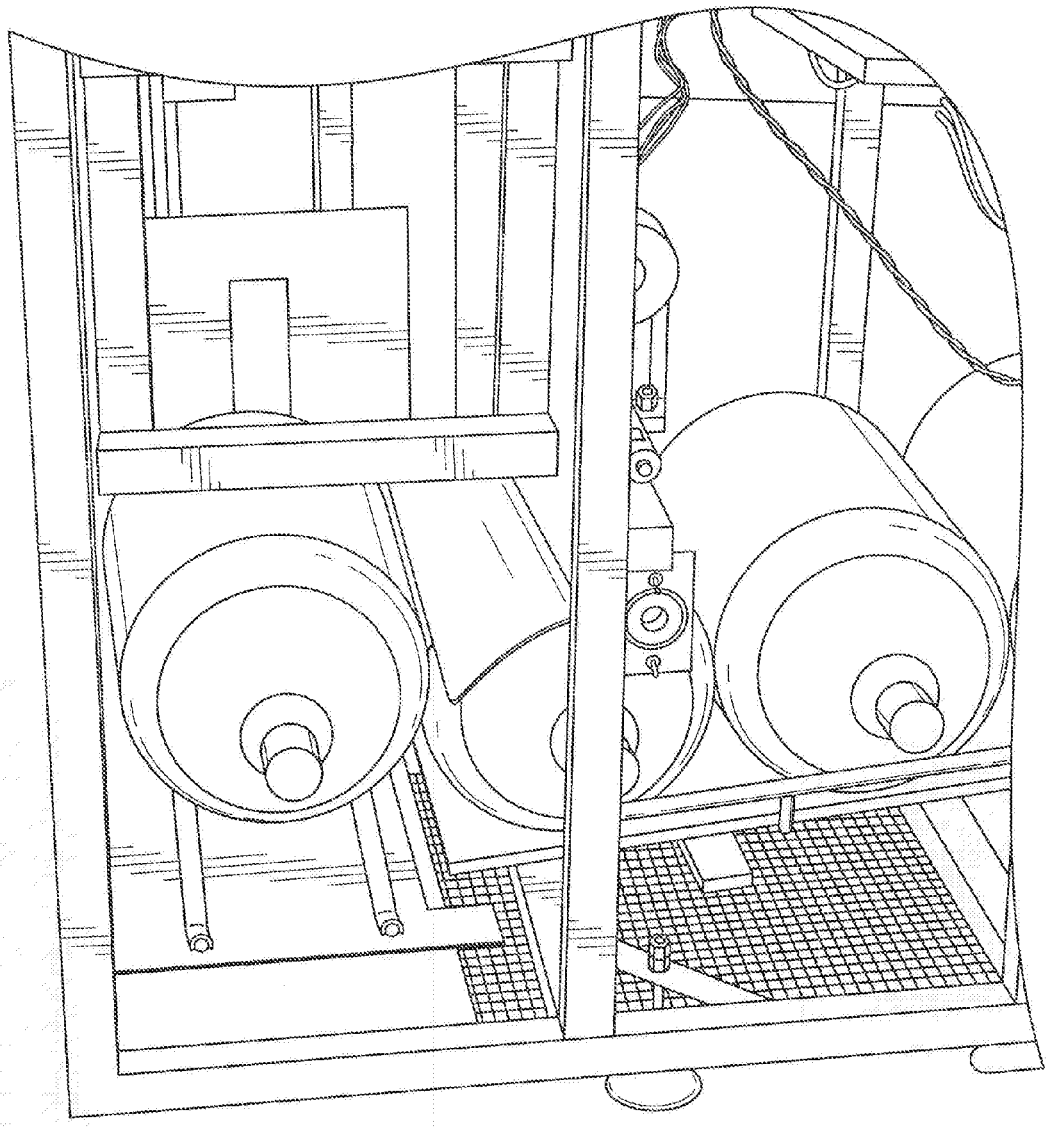


FIG. 155

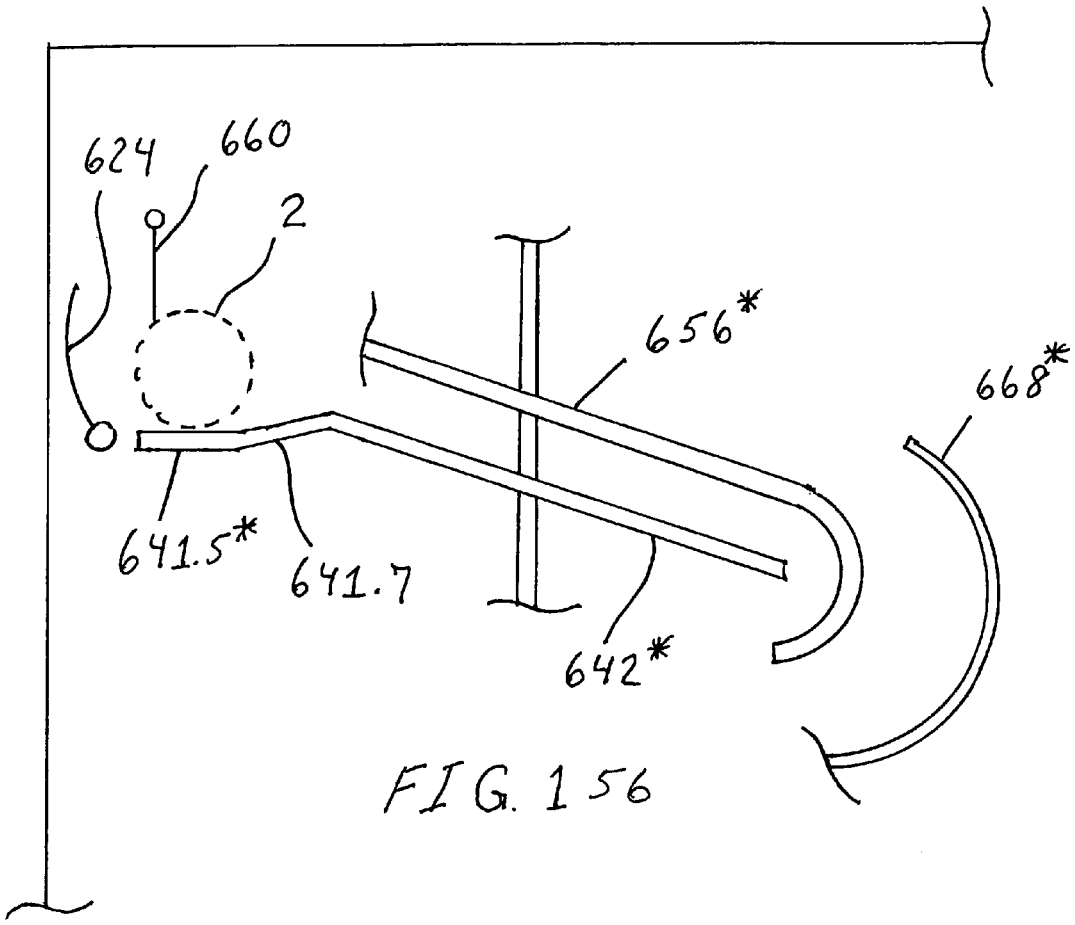



FIG. 156

# LARGE BOTTLE VENDING APPARATUS AND METHOD

## CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S, Provisional Application Ser. Nos. 61/654,585, filed Jun. 1, 2012; 61/568,661, filed Dec. 9, 2011; 61/560,835, filed Nov. 17, 2011; and 61/546,091, filed Oct. 12, 2011, This application is a continuation in part of U.S. Regular Utility application Ser. No. 13/407,452, filed Feb. 28, 2012. The contents of all the prior patent applications listed herein are incorporated in their entirety herein by reference.

## FIELD OF THE DISCLOSURE

The disclosure relates generally to a vending apparatus for vending consumable goods and for receiving emptied reusable containers for the consumable goods. More specifically, the disclosure relates to an apparatus for vending large volume water bottles and receiving emptied re-sanitizable and reusable bottles.

## BACKGROUND OF THE DISCLOSURE

Potable, portable water has become an increasingly sought-after and commonplace commodity by modern day consumers. Whether natural spring water or purified and/or re-mineralized drinking water, to address varying consumer demands for convenience and availability, water vendors have developed a number of bottle sizes and approaches for dispensing and delivering water. One such approach described more fully below uses established food stores, e.g., supermarkets and wholesale establishments, within which bottled water in varying sizes is offered on store shelves. A second approach is to offer larger 3 and 5 gallon bottles, often stacked independently of the market's shelves due to their considerable weight, which are to be used with water coolers for dispensing.

For companies involved in the home and office water delivery business, competition with respect to price, service, contract terms, availability of product, consistency of product, permitting in and out of state, delivery expenses including the acquisition of, or lease of, government approved trucks, fuel costs, tolls, taxes, maintenance and repair, labor and labor related benefits all add considerably to the cost of the delivered water. Additional costs such as a sales force, bookkeeping department, plant inventory, delivered inventory, truck-loaded inventory, FIFO handling of product inventory, further add to the cost. Regional weather issues can affect deliveries to homes, offices and apartment buildings.

An additional problem is the use of rented water coolers. Companies providing on-site delivery services that rent coolers to their customers have to deal with repair and maintenance, cleaning, billing and collection of rental fees.

A yet further set of issues with respect to the home/office delivery business concerns state permitting practices and procedures. States vary considerably in their permitting requirements such that one company may decide against doing business in certain states to avoid disparate permitting requirements.

Distribution of particular brands of water for home/office delivery may be further restricted by geographical considerations, such as distance from a bottling facility. Many homes and businesses may be outside the feasible mileage radius of the bottling plant to warrant delivery at a competitive or acceptable price. The end result is the delivery of bottles and coolers along with all the related costs creates a fractionalized cost model that requires high volume to achieve low margins.



Similar problems surface with the distribution of 3 and 5 gallon bottles through supermarket and wholesale club stores. "Centralizing" distribution does centralize costs and simplify bottle delivery and empty bottle pickup. It also reduces or eliminates many of the other problems associated with home/office delivery. Problems such as billing and collection, however, still remain, even though on a centralized, e.g., consolidated manner, the bottler is invoicing the supermarket and wholesale stores versus invoicing the individual home and/or office customers. One solution to the invoicing issue is to rely on the retailer to electronically transfer funds directly and automatically. This has become increasingly popular with the advent of e-commerce.

In this particular model of distribution, the customers serve themselves and prepay for the bottled water product at a central location versus being invoiced separately at dispersed locations for the delivered purchase and/or cooler rental. In most cases, the customer will also be required to prepay for the bottle when purchased. Furthermore in this distribution model, the particular retailer and not the customer governs the location and hours of operation. As an added difficulty/inconvenience, the customer must handle the product in order to get the 3 and/or 5 gallon bottle to their vehicle from inside the store while often simultaneously shopping for other items inside the store (depending upon whether it's a grocer or retailer, this can be a significant limitation). And often times, this will result in a separate trip back and forth to the vehicle and back and forth to customer service to return empties, and in some cases, to receive a voucher to present to a cashier as a credit against the purchase of a new bottled water product and then out to the vehicle (or continue to shop inside the store before travelling back to the vehicle). This can have the unfortunate effect of limiting sales and causing probable inconvenience.

This model of distribution has significant temporal and convenience limitations as it relies entirely on the individual store hours and on the location(s) of the stores. A further inconvenience and limitation is the location(s) inside those stores where bottles are returned and where bottles are purchased and retrieved. Added to this is the common practice of using vouchers to confirm bottle returns for a return-bottle credit, which, if lost, cannot be used to obtain a credit against a subsequent purchase of a filled bottle.

A substantial reason why water bottles are sold in stores is due to the effect of climate and weather on water. If left exposed to the elements—even in sealed containers—water can freeze, get stolen, and/or overheat. In the alternative, even if the bottled water were to be stacked outside the store on the sidewalk (so to speak) for purchase, it would have to be brought back into the store at closing to reduce the risk of theft and to prevent freezing in colder climates. By way of example, there can be as many as 75-100 bottles stacked on the shelves of wholesale clubs. If not left inside the store, but displayed for sale outside, the bottles would need to be taken in each and every night. It should come as no surprise that water bottles sold by wholesale clubs are more likely to sell the bottles from store racks/shelves inside the club facilities.

Not only does this model create extra effort and handling for the customer, just as importantly, it places a constant burden on the retailer as it can involve the ongoing and tedious tasks of price-labeling, of handling the piles of empties and of planning the use of valuable floor/shelf space in designated "water aisles" such as those found in a supermarket or a Wal-Mart store. The same burden is experienced when the

bottles are placed on separate shelving or pallets in retail stores such as Home Depot, or Lowe's, or in food clubs such as B.J.'s Wholesale Club, Sam's Club, Costco, etc. These problems are exacerbated by the fact that these self-serve products weigh about 44.5 lbs. per five gallon bottle and about 25.5 lbs. per 3 gallon bottle. This creates significant handling logistics for both the consumer and the store. For example, a 5 gallon bottle typically takes up an 8"D-10½" D×13"H space for a 3 gallon bottle and an 11"D×20"H space for a 5 gallon bottle. Sales of, and even profits derived from, this product can sometimes be negated by the extra handling and "shelf-space" required.

Several other problems involving this distribution model are not readily apparent. For example, in the case of a grocery store, the customer must carry the 45 lb. and/or 25 lb. bottles around the store in a grocery cart, wait in line for a check-out clerk and then bring the bottle out to his or her vehicle sometimes in snow, ice or rainy weather conditions and across a parking lot to their parking space which could be several hundred feet or yards away. This scenario repeats itself in the wholesale and retail stores and only worsens because the customer must park their car; bring any empties to the "customer service area" to redeem their deposit(s) and get a receipt; go to the cashier (wait in another line); pay for a new bottle(s) of water; go to the location where the 3's and 5's are kept; pick them up and place them in a basket carrier and then wheel them out to their vehicle, much the same as in the supermarket model. This is not the most customer friendly or convenient delivery model and again can stifle sales because many, if not most, shoppers at supermarkets are consumers doing their weekly shopping. In this scenario, buying drinking water in large quantities is not necessarily a "destination", or convenient purchase."

In an improved form of distribution, 3 and 5 gallon bottled water can be distributed in a vending machine designed to handle both 3's and 5's of bottled water and 3's and 5's of empty returns. This is accomplished using a single piece of equipment in one location only, located outside the retailer's store on a sidewalk, "end-cap", or some other similar, customer friendly location where customers can drive up, buy and return their bottles (24/7) and be on their way, or to shop if they choose, and then purchase their water on the way out of the store.

In this novel distribution system, customers aren't reliant on retailer's hours of operation; both the bottle return and the purchase of the product are in the same machine; customers are guaranteed an FDA and Board of Health approved product "packaged" and not delivered "bulk." Customers don't have to bring their own "clean and sanitary" containers. The system is a cashless transaction which should help, if not eliminate theft because the vendor is an unmanned unit 24/7. It further provides a convenient method of payment for the consumer because they can utilize one of three or four methods of payment. If cash is preferable, the system can accept a prepaid water card, which can be purchased from the retailer. This method of payment is also compatible with retailers' cross-promotions whereas they can receive discounts off their purchase by using special retailer coupons and/or retailer "advantage" cards.

The vending apparatus is very well lighted and safe in appearance and customer-friendly to operate. The only trucking required is "on demand" because the unit is wireless and will communicate with the manufacturer's/dispatch control center when the vending apparatus is low on inventory. A "return bottle" well/window is a vendor controlled RFID or a bar coded Unique Identification Number (UID) acceptable only to that bottler's product bottles for the amount paid when first purchased. Many unnecessary and unwanted business expenses and inconveniences are now eliminated with the present disclosure. The apparatus includes clear, multilingual signage to assist customers with their purchases unlike the other models of distribution. There is no bookkeeping to speak of as the system is wireless and automated for all parties concerned. The size and shape of the vendor machine is expandable or contractible and will be dependent on the location, and re-fill delivery costs.

There are no building permits or other special permits/license fees required unlike some other types of vending and distribution systems as the vending apparatus is NAMA and U/L pre-approved before placement at their retail location(s). There are hundreds of various models and types of vending machines but almost all of those machines and kiosks that sell "packaged/bottled" water or soft drinks are "small pack" sizes and do not address the larger 3 and 5 gallon size. All other water vending machines are either "unpackaged" bulk water vending machines that require the customer to bring their own "clean, sanitary containers". These machines are heavily regulated on an individual location basis requiring, in many cases, both local and state permits and licenses from boards of health, plumbing, building and wiring inspectors as well as local water quality agencies such as the California Department of Health; the Rhode Island Board of Health; the Massachusetts Department of Environmental Protection (DEP); the New York Department of Health; the Massachusetts Board of Health; the Licensing Board of Certified Operators; just to name a few. The disclosed vending apparatus eliminates these requirements because all necessary permitting issues are already in effect before the product is loaded into the truck to deliver to the vending apparatuses at their retail location(s).

In both of the known self-service vending systems, the "Return Bottle" area is located generally in a customer service area located as one enters the retail store where the "return" is either put in a designated "Return Bottle Area" (loose and unconstrained) or in a "Return Bottle" enclosed compartment that accepts all bottles from all vendors and prints a "refund" slip to be cashed in when purchasing a new filled bottle at a location elsewhere in the store. It is then the customer's chore to push a grocery art with their bottled water which can weigh as little as 25 lbs per 3 gallon bottle or as much as 45 lbs for a 5 gallon bottle and more, depending on the number of bottles purchased, out to their vehicle located some distance from the store exit. The disclosed vending apparatus eliminates these inconveniences and problems as well.

## SUMMARY OF THE DISCLOSURE

Unless specified, as used herein, large-volume water bottles shall mean reusable water bottles holding one or more gallons of fluid. In one aspect of the disclosure, a combination vending/return apparatus includes a modular vending segment including preset graded conveyor assemblies for receiving filled water bottles for vending. The conveyor assemblies are positioned adjacent to a vending shelf that presents bottles for retrieval by customers. A locked vending door is situated in a front wall of the vending segment aligned with the vending shelf to allow customer access to the bottles and to prevent unwanted bottle removal. A credit/debit/prepaid card acceptor provides a means for a customer to make purchases and receive credits for returned bottles. A completed electronic purchase transaction unlocks the vending door after which a customer can remove the purchased bottle from the apparatus. A bottle guide rail assembly and locking collars retain

bottles on the conveyor assemblies in a controlled manner and allow incremental movement of bottles toward the vending shelf as purchases are made and bottles are removed.

In a return segment of the apparatus, a return chute is formed in a front face of the segment dimensioned to receive specific-sized bottle returns. A series of sensors and readers confirm the bottle type and identification information for processing a return credit to the customer's account. The combination vending segment and return segment provide one-stop complete bottled water paperless transactions other than printed receipts. In another aspect of the disclosure, the system includes access to 24/7 service to accommodate any issues resulting from a purchase/return event.

In another aspect of the disclosure, a conveyor-belt driven vending segment of a vending/return apparatus increases the number of bottles deliverable within a single apparatus. The conveyor belt assemblies can be provided in multiple rows, each of which includes a central geared bottom track in communication with a geared motor drive controlled by a central processor. The credit/debit/prepaid card acceptor sends signals to the central processor that further sends signals to the conveyor motor(s) to advance the conveyor to deliver a water bottle to a customer retrieval location. The location includes a sliding and lockable vending door for access to the purchased bottles. A shelf can be further included to enhance the convenience of purchasing multiple bottles.

In yet another aspect of the disclosure, a vending/return apparatus with a vending elevator system further increases the number of bottles deliverable from a single apparatus. Air operated, and/or electric actuators are provided to move a vending elevator along a minimum of a single horizontal axis per row, or at least two axes to received bottles positioned on multiple row and column conveyor assemblies.

In a further aspect of the disclosure, a front load and vend apparatus uses gravity fed conveyors to deliver purchased bottles to customers. The apparatus further allows vendors to retrieve returned emptied bottles from the front end from a conveyor superposed about the delivery conveyors.

In a still further aspect of the disclosure, a vending/return transaction system provides a means for conducting a paperless transaction to purchase and return bottled water and empty bottles, respectively. These and other aspects and objects of the disclosure will become apparent from a review of the appended drawings and the detailed description below.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a plan view of a vending/return apparatus according to one embodiment of the disclosure.

FIG. **2** is a side elevational view of the vending/return apparatus shown in FIG. **1**.

FIG. **3** is a top plan view of a vending/return apparatus according to another embodiment of the disclosure.

FIG. **3**A is a sectional view of a bottle guide according to one embodiment of the disclosure.

FIG. **4** is a side elevational view of a vending/return apparatus according to the embodiment shown in FIG. **3**.

FIG. **5** is a perspective view of a bottle advancing assembly according to one embodiment of the disclosure.

FIG. **6** is a top perspective view of a vending shelf and bottle restriction frame according to one embodiment of the disclosure.

FIG. **7** is a plan view of an atypical credit/debit card acceptor and receipt printer according to one embodiment of the disclosure.

FIG. **8** is a plan view of an atypical credit/debit card acceptor and receipt printer according to another embodiment of the disclosure.

FIG. **9** is a top view of a conveyor assembly according to one embodiment of the disclosure.

FIG. **10** is a side elevational view of a vending segment according to a yet further embodiment of the disclosure.

FIG. **11** is a top view of the vending segment shown in FIG. **10**.

FIG. **12** is a side elevational view of the vending segment shown in FIG. **10**.

FIG. **13** is a top perspective view of a bottle control conveyor assembly according to one embodiment of the disclosure.

FIG. **14** is a side elevational view in partial phantom of the vending segment shown in FIG. **10**.

FIG. **15** is a front elevational view of the vending segment shown in FIG. **10** combined with a return segment to form a vending/return apparatus.

FIG. **16** is a top view of the vending/return apparatus shown in FIG. **15**.

FIG. **17** is a side sectional view of the vending/return apparatus shown in FIG. **15**.

FIG. **18** is a front view of a yoke assembly according to one embodiment of the disclosure.

FIG. **19** is a front view of a yoke assembly pusher according to one embodiment of the disclosure.

FIG. **20** is a front sectional view of a vending elevator assembly of the vending/return apparatus shown in FIG. **15**.

FIG. **21** is a front view of a return door for a return segment of a vending/return apparatus according to one embodiment of the disclosure.

FIG. **22** is a side elevational view of a return door according to the embodiment shown in FIG. **21**.

FIG. **23** is a front view in partial phantom of a vending door of a vending segment of a vending/return apparatus according to one embodiment of the disclosure.

FIG. **24** is a top view of the vending door shown in FIG. **23**.

FIG. **25** is a side elevational view of the vending door shown in FIG. **23**.

FIG. **25**A is a side sectional view of the vending door shown in FIG. **23**.

FIG. **26** is a front elevational view of a modular return door frame according to one embodiment of the disclosure.

FIG. **27**A is a system flow chart for retrieving and returning water bottles, and conducting a paperless transaction for the purchasing and crediting sales/return transactions according to one embodiment of the disclosure.

FIG. **27**B is a continuation of the system flow chart of FIG. **27**A.

FIG. **28** is a side sectional view of a vending/return apparatus according to another embodiment of the disclosure.

FIG. **29** is a front sectional view of a vending apparatus according to the embodiment shown in FIG. **28**.

FIG. **30** is a side sectional view of a vending apparatus according to a yet further embodiment of the disclosure.

FIG. **31** shows perspective views of a vending door according to another embodiment of the disclosure.

FIG. **32** is a side sectional view of a vending apparatus according to a yet further embodiment of the disclosure.

FIG. **33** is a side sectional view of the embodiment shown in FIG. **32**.

FIG. **34** is a side sectional view of a further embodiment of the disclosure.

FIG. **35** is a side sectional view of a yet further embodiment of the disclosure.

FIG. **36** is a side elevational view of a vending apparatus according to a still further embodiment of the disclosure.

FIG. **37** is a front elevational view of the vending apparatus shown in FIG. **36**.

FIG. **38** is an expanded view of area A shown in FIG. **36**.

FIG. **39** is a side elevational view of a combination first track subassembly and curve according to the embodiment shown in FIG. **36**.

FIG. **40** is a top view of the track subassembly shown in FIG. **39**.

FIG. **41** is an end view of the track subassembly shown in FIG. **39**.

FIG. **42** is a side elevational view of a combination second track subassembly and curve according to the embodiment shown in FIG. **36**.

FIG. **43** is a top view of the track subassembly shown in FIG. **42**.

FIG. **44** is an end view of the track subassembly shown in FIG. **42**.

FIG. **45** is a side elevational view of a combination third and fourth track subassemblies according to the embodiment shown in FIG. **36**.

FIG. **46** is a top view of the third track subassembly shown in FIG. **45**.

FIG. **47** is a top view of the fourth track subassembly shown in FIG. **45**.

FIG. **48** is a perspective view of a return bottle cradle assembly according to the embodiment shown in FIG. **36**.

FIG. **49** is an operational schematic in partial phantom of the combination return door and return bottle cradle assembly according to the embodiment shown in FIG. **36**.

FIG. **50** is an operational schematic in partial phantom of the elevator according to the embodiment shown in FIG. **36**.

FIG. **51** is an operational schematic in partial phantom of the bottle vend gate according to the embodiment shown in FIG. **36**.

FIG. **52** is an operational schematic of the heating and venting assembly according to the embodiment shown in FIG. **36**.

FIG. **53** is an exploded view of an elevator assembly according to the embodiment shown in FIG. **36**.

FIG. **54** shows a perspective view of a vend gate according to the embodiment shown in FIG. **36**.

FIG. **55** shows a rear elevational view of the internal components of a vending apparatus according to the embodiment of the disclosure shown in FIG. **36**.

FIG. **56** is a bottom view of the vending apparatus shown in FIG. **55**.

FIG. **57** is a partial back view of a vending apparatus loading assembly of the vending apparatus shown in FIG. **55**.

FIG. **58** is a front elevational view in partial phantom of the vending apparatus shown in FIG. **55**.

FIG. **59** is a side elevational view of the vending apparatus shown in FIG. **58**.

FIG. **60** is a side elevational view of a side of the vending apparatus opposite the side shown in FIG. **59**.

FIG. **61** is a top view of the vending apparatus shown in FIG. **58**.

FIG. **62** is a side view of a bottle advancing rod according to the embodiment of the disclosure shown in FIG. **36**.

FIG. **63** is a front view of the bottle advancing rod shown in FIG. **62**.

FIG. **64** is a perspective view of a vending apparatus leveling assembly according to the embodiment of the disclosure shown in FIG. **36**.

FIG. **65** is a front elevational view in partial phantom of the leveling assembly shown in FIG. **64**.

FIG. **66** is a top view in partial phantom of the leveling assembly shown in FIG. **64**.

FIG. **67** is a perspective view of a vending gate lock assembly according to the embodiment of the disclosure shown in FIG. **36**.

FIG. **68** is a front view in partial phantom of the lock assembly shown in FIG. **67**.

FIG. **69** is a top view of the lock assembly in partial phantom shown in FIG. **67**.

FIG. **70** is a side elevational view of the lock assembly shown in FIG. **67**.

FIG. **71** is a front elevational view of the exterior of the vending apparatus according the embodiment of the disclosure shown in FIG. **36**.

FIG. **72** is a side elevational view of the exterior of the vending apparatus shown in FIG. **71**.

FIG. **73** is a side elevational view of the exterior of the vending apparatus according to another embodiment of the disclosure.

FIG. **74** is a side elevational view of the exterior of the vending apparatus shown in FIG. **73**.

FIG. **75** is a perspective view of an adjustable inertia restriction flapper according to a further embodiment of the disclosure.

FIG. **76** is a perspective view of an adjustable inertia restriction flapper shown in FIG. **75** in an actuated position engaged by a filled bottle.

FIG. **77** is a perspective view of a plurality of stationary inertia restrictors according to a yet further embodiment of the disclosure.

FIG. **78** is a side view of the rail guides and transition guide rails according to the embodiment of the disclosure shown in FIG. **36**.

FIG. **79** is a perspective view of the transition guide rails shown in FIG. **78**.

FIG. **80** is a perspective view of a spring actuated inertia restrictor flapper positioned between track guide rails according to a still further embodiment of the disclosure.

FIG. **81** is a side view of a stationary inertia restrictor according to the embodiment shown in FIG. **77**.

FIG. **82** is a close-up view of the stationery inertia restrictor shown in FIG. **77**.

FIG. **83** is a side elevational view of a track assembly with stationary inertia restrictors according to the embodiment of the disclosure shown in FIG. **77**.

FIG. **84** is a comparison view of stationary inertia restrictors having different thicknesses.

FIG. **85** is a side elevational view of the stationary inertia restrictors shown in FIG. **84**.

FIG. **86** is a side elevational view of beveled and unbeveled stationary inertia restrictors.

FIG. **87** is a perspective view of the vending apparatus according to the embodiment of the disclosure shown in FIG. **36**.

FIG. **88** is a back elevational view of the elevator and elevator winch assembly according to the embodiment of the disclosure shown in FIG. **36**.

FIG. **89** is a bottle arrestor assembly according to another embodiment of the disclosure.

FIG. **90**A is a system flow chart for retrieving and returning water bottles, and conducting a paperless transaction for the purchasing and crediting sales/return transactions according to the embodiment of the disclosure shown in FIG. **36**.

FIG. **90**B is a continuation of the system flow chart shown in FIG. **90**A.

FIG. **90A1** is a system flow chart for retrieving and returning water bottles, and conducting a paperless transaction for

the purchasing and crediting sales/return transactions according to the embodiment of the disclosure shown in FIG. **36**.

FIG. **90B1** is a continuation of the system flow chart shown in FIG. **90A1**.

FIG. **90C1** is a continuation of the system flow chart shown in FIGS. **90A1** and **90B1**.

FIG. **91A** is a flow chart of vending apparatus screen shots according to one embodiment of the disclosure.

FIG. **91B** is a continuation of the flow chart shown in FIG. **91A**.

FIG. **91C** is a continuation of the flow chart shown in FIGS. **91A** and **918**.

FIG. **92** shows the bottle arrestor assembly shown in FIG. **89** in a lead-bottle-arrested orientation.

FIG. **93** is a top perspective view of apparatus **620** according to one embodiment of the disclosure.

FIG. **94** is a side view of apparatus **620** according to one embodiment of the disclosure.

FIG. **95** is a close-up view of detail "C" in FIG. **94**.

FIG. **96** is a close-up view of detail "D" in FIG. **94**.

FIG. **97** is a partial sectional front view of apparatus **620** according to one embodiment of the disclosure.

FIG. **98** is a close-up of detail "A" in FIG. **97**.

FIG. **99** is a close-up view of detail "B" in FIG. **97**.

FIG. **100** is a back elevational view of apparatus **620** according to one embodiment of the disclosure.

FIG. **101** is a top view of apparatus **620** according to one embodiment of the disclosure.

FIG. **102** is a right elevational view of apparatus **620** according to one embodiment of the disclosure.

FIG. **103** is a side elevation view of elevator assembly **702** according to one embodiment of the disclosure.

FIG. **104** is a front elevational view of elevator assembly **702** shown in FIG. **103**.

FIG. **105** is a top back perspective view of vend door **726** according to one embodiment of the disclosure.

FIG. **106** is a side view of bottle support rod **712** according to one embodiment of the disclosure.

FIG. **107** is a front elevational view of support rod **712** shown in FIG. **106**.

FIG. **108** is a front elevational view of plate according to one embodiment of the disclosure.

FIG. **109** is a side elevational view of the plate shown in FIG. **108**.

FIG. **110** is a back elevational view of vend door **726** according to one embodiment of the disclosure.

FIG. **111** is a side elevational view of vend door **726** shown in FIG. **110**.

FIG. **112** is a front perspective view of vertical guide **718** according to one embodiment of the disclosure.

FIG. **113** is a front elevational view in partial phantom of vertical guide **718** shown in FIG. **112**.

FIG. **114** is a side elevational view in partial phantom of vertical guide **718** shown in FIG. **112**.

FIG. **115** is a side elevational view of ejector rod **782** according to one embodiment of the disclosure.

FIG. **116** is a side elevational view in partial phantom of ejector rod **782** shown in FIG. **115**.

FIG. **117** is a front elevational view of access door **810** according to one embodiment of the disclosure.

FIG. **118** is a top view of access door **810** shown in FIG. **117**.

FIG. **119** is a vertical bottle alignment guide according to one embodiment of the disclosure.

FIG. **120** is a perspective view of cradle **624** with a modified perforated body according to another embodiment of the disclosure.

FIG. **121** is a top view of cradle **624** shown in FIG. **120**.

FIG. **122** is a side view of cradle **624** shown in FIG. **120**.

FIG. **123** is a top view of a horizontal bottle alignment guide according to one embodiment of the disclosure.

FIG. **124** is a top perspective view of the horizontal alignment guide shown in FIG. **123**.

FIG. **125** is a side elevational view of the horizontal alignment guide shown in FIG. **123**.

FIG. **126** is a front elevational view of the horizontal alignment guide shown in FIG. **123**.

FIG. **127** is a top perspective view of a beam and inertia restrictor assembly for a first track assembly according to one embodiment of the disclosure.

FIG. **128** is a top perspective view of a beam and inertial restrictor assembly for a second track assembly according to one embodiment of the disclosure.

FIG. **129** is a top front perspective view of a modified elevator assembly **702** with a partial cylindrical position guide **702***a* according to another embodiment of the disclosure.

FIG. **130** is a top back perspective view of access door **810** with lock assembly according to one embodiment of the disclosure.

FIG. **131** is a back elevational view of access door **810** with lock assembly shown in FIG. **130**.

FIG. **132** is a back perspective view of access door **810***a* without lock assembly according to one embodiment of the disclosure.

FIG. **133** is a back elevational view of access door **810***a* show in FIG. **132**.

FIG. **134** is a top view of a segmented LED light strip according to one embodiment of the disclosure.

FIG. **135** is a side partial phantom view of the LED light strip shown in FIG. **134**.

FIG. **136** is a side sectional view of the LED light strip shown in FIG. **134**.

FIG. **137** is a top view of a continuous LED light strip according to another embodiment of the disclosure.

FIG. **138** is a side partial phantom view of the LED light strip shown in FIG. **137**.

FIG. **139** is a side sectional view of the LED light strip shown in FIG. **137**.

FIG. **140** is a solid model back perspective view of a lock rod and gate assembly **740** according to one embodiment of the disclosure.

FIG. **141** is a solid model front perspective view of the lock rod and gate assembly **740** shown in FIG. **140**.

FIG. **142** is a photograph of a back top perspective view of the lock rod and gate assembly **740** shown in FIG. **140**.

FIG. **143** is a close-up view photograph of the lock rod engagement to the gate assembly shown in FIG. **140**.

FIG. **144** is a close-up view photograph of the lock rod disengaged from the gate assembly shown in FIG. **140**.

FIG. **145** is a side elevational view of an ejector plate assembly according to another embodiment of the disclosure.

FIG. **146** is a side perspective view of the ejector plate assembly shown in FIG. **145**.

FIG. **147** is a front perspective view of a combination vend/return bottle apparatus according to a further embodiment of the disclosure.

FIG. **148** is a side elevational view of the vend/return bottle apparatus shown in FIG. **147**.

FIG. **149** is a top front perspective view of a gate assembly according to a further embodiment of the disclosure.

FIG. **150** is a top back perspective view of the gate assembly shown in FIG. **149**.

FIG. **151** is a side elevational view in partial phantom of a vend/return bottle apparatus according to a yet further embodiment of the disclosure.

FIG. **152** is a front sectional view of a track assembly including transitional guide rails according to the embodiment of the disclosure shown in FIG. **151**.

FIG. **153** is a back right perspective view of the vend/return apparatus shown in FIG. **159**.

FIG. **154** is a front perspective view of the vend/return apparatus shown in FIG. **151**.

FIG. **155** is a second front perspective view of the gate assembly and elevator assembly with a full bottle loaded on the elevator according to the embodiment of the disclosure shown in FIG. **151**.

FIG. **156** is a side view of a first segment of the first track assembly having a start shelf of the vend/return apparatus according to the embodiment of the disclosure shown in FIG. **151**.

## DETAILED DESCRIPTION OF THE DISCLOSURE

In one aspect of the disclosure as shown in FIGS. **1** and **2**, a combination vending/return apparatus **10** includes a bottle vending segment **12** and bottle return segment **14**. Return segment **14** includes a return chute **16** for receiving empty bottles. A sensor (not shown in FIG. **1**) is situated inside the chute face to sense the delivery of an emptied bottle to commence a credit transaction described hereinbelow. Emptied bottles slide down chute **16** and become deposited in return segment **14**. A return door **18** allows access to the return segment space to retrieve emptied bottles for further processing, refilling, etc. A credit/debit/pre-paid water card acceptor **20** provides an electronic interface between apparatus **10** and a customer to process vending/return transactions. The details of acceptor **20** are described further herein.

Vending segment **12** includes a series of gravity-feed, roller-type conveyor assemblies **22** that permit loading and unloading of bottled water. Assemblies **22** are graded to urge bottles towards the front of segment **12** as shown in FIG. **2**. Assemblies **22** are dimensioned to handle specific sizes of bottles. The dimensions are modified as needed to accommodate a wide range of bottle shapes and sizes including, but not limited to, rectangular and cylindrical. Positioned between a front edge of assemblies **12** and the front wall of segment **12** is vending shelf **19** configured to be substantially horizontal and substantially orthogonal relative to the front wall. A flapper switch **23** is positioned to extend upwardly from shelf **19** so as to be depressed and triggered by the presence of a water bottle on shelf **19**. Both the conveyor assemblies **22** and vending shelves **19** are secured to and supported by an apparatus frame structure including framing members **21**.

To ensure the surfaces of, and orientation of, apparatus **10** are plumb, square and level, threaded leveling pads **38** are positioned at the corners and alternatively at other selected areas of the bottom of apparatus **10**. Each pad **38** is torqued to ensure proper and even weight displacement of apparatus **10**.

Bottles **2** are loaded into apparatus **10** from the front of the apparatus by opening vending doors **28** (described more fully below) aligned with each vending row, and by disengaging a locking collar **26** (also described more fully below), and pivoting in an upward direction a bottle guide rail assembly **24** from a pivot hinge **25**. In an alternative embodiment, the entire front panel of segment **12** can be configured as a door to allow access to all vending rows with a single door. Bottles **2** introduced into a row are urged back by each successive bottle loaded onto the row until the inner real wall of the apparatus is engaged by the back-most bottle. Once a row is fully loaded with bottles, bottle guide assembly **24** is pivoted in a downward direction so as to place locking collar **26** in contact with the front edge of the front-most bottle's neck portion.

Each row includes bottle guide **24** to keep loaded bottles aligned with conveyor assemblies **22**. Bottle guide **24** includes a pair of substantially parallel rails spaced to receive the mid-neck portions of the bottles. The spacing is adjusted to allow free movement of the bottles along the length of guide **24**. A front end of each rail includes an articulating arm **29** that pivots about a locking hinge pin **27** mechanically operated and electrically controlled by the processor. Each arm **29** has at a proximal end, a locking collar **26** in the form of a magnetic pin that opens and closes with a solenoid device controlled by the processor. A second pin **26***a* is positioned in arm **29** so as to come into contact with the second-most forward bottle and directly arrests forward movement of the bottle adjacent the front vending end of segment **12**. Bottles distal to the front two bottles are also restrained from advancing along conveyor assemblies **22** by resting against the front bottles.

The pins are operated sequentially. The front pin is released first to allow the first bottle to travel onto the vending shelf and then closed with the second pin opening thereafter to allow the second bottle to ride down the conveyor until it comes into contact with the front pin. The bottle immediately behind the second bottle migrates via gravity or power assist into the second bottle slot. Each bottle thereafter makes a similar incremental migration toward the first position.

Aligned with each conveyor assembly is vending door **28**. As shown in FIG. **1**, a plurality of doors **28** may be arranged in a series of rows and columns to correspond with rows and columns of conveyor assemblies **22**. Vending door **28** can be made of any resilient material such as aluminum, steel and/or any polymer products well known in the art. In one embodiment, Lexan® in a bluish color version is used for its ultraviolet light protection qualities. Shielding the bottles from UV light penetration is an important consideration in the selection of materials for the door as well as the entire unit to prevent bacterial formation or algae that can form by constant exposure to direct sunlight. The opacity of the other disclosed materials serves the same function.

Each door **28** includes a handle **30** to allow a customer to open the door to retrieve a bottle after a payment transaction has been completed as described below. An electronic door latch (shown in FIG. **2**) for each door **28** maintains each door in a locked configuration to secure the bottles from unwarranted removal.

To unlock a vending door, a customer must first use a credit/debit card, or prepaid card to institute a credit/debit transaction with acceptor **20**. Once a payment transaction has been completed successfully, a processor (not shown) selects a vending door to unlock based on the availability of bottles in a particular vending row. Sensors, such as photocell **42**, strategically placed throughout apparatus **10** provide feedback as to the quantity and location of bottles in the apparatus. The customer is given a visual signal at each door, and/or audible message on a screen and/or via a speaker system built into apparatus **10** and connected to the processor. The message informs the customer which door has been selected. The processor then sends a signal to disengage locking collar **26** that rotates upwardly to release the front-most bottle that travels onto vending shelf **23**. Once on the shelf, bottle **2** depresses flapper switch **23**, which, in turn, unlocks the adjacent vending door **28** and sends a signal to the processor to re-engage locking collar **26**. It should be understood all elec-

tronically manipulated components of the vending/return apparatus are controlled by the computer processor.

After locking collar **26** has been re-engaged, the second pin **26** is opened to allow the formerly second-most forward bottle to travel forward on the conveyor via gravity until the previously second-most forward bottle occupies the space formerly occupied by the first-most forward bottle. Since this is "gravity fed" the remaining bottles shift forward accordingly. The presence of the front-most bottle on the shelf that remains stationary provides an auxiliary second physical barrier to prevent the other bottles from being released onto the shelf until the front-most locking collar is re-engaged. In an alternative embodiment, one or more rollers can be electrified or motorized to assist the gravity-feed system. If power rollers are used, conveyor assemblies **22** may be configured in a substantially horizontal orientation in lieu of being "gravity fed." However, this could add substantial cost of manufacturing to the vendor unit.

To complete the bottle retrieval process, the customer grabs handle **30** and opens the door to retrieve the available bottle. Once the bottle is retrieved, flapper switch **23** resumes its start position for the next vending cycle and sends a signal to the processor to lock the door. Spring actuation urges the opened door to the "closed" position after being released by the customer, which allows the electronic latch to be placed in a locked condition. It should be understood and appreciated by those having skill in the art that flapper switch **23** can be substituted with pressure and/or light sensor switches to determine the presence of a bottle on vending shelf **23**.

To better assist the customer with the purchase in any light conditions, lights **36** are positioned over each door. Lights **36** may be maintained in an "on" condition are triggered via a switch operated by vending door **28**. In the latter embodiment, lights **36** turn on when door **28** is in an "open" configuration. When door **28** is closed, a surface of the door contacts and depresses the switch to turn off light **36**. A light may further be provided over acceptor **20** to provide lighting assistance to a customer operating credit card acceptor **20**. This light too, may be controlled to operate only when acceptor **20** has been engaged.

Because apparatus **10** may be placed in a wide variety of geographic locations with substantially different weather patterns and climates, apparatus **10** is configured to be a climate-controlled unit. Foam insulation (or an equal type of insulation) **32** lines substantially all inner walls, ceiling and floor of apparatus **10**. Heating units **34** are controlled by the processor to maintain the inside temperature of apparatus **10** at a preselected temperate in cold climate conditions. Heating units **34** may be thermostatically controlled, atypical fan-type electric heaters or even the implementation of solar powered heaters. An optional access door **40** may be included in the front, side and/or back of the apparatus to allow access to the mechanical systems including the heating and cooling systems and for loading and unloading the three and five gallon bottles.

In warm climate conditions, an air conditioning unit (now shown) is incorporated into apparatus **10** and operated by the processor. Again, the inner temperature of apparatus **10** is maintained at a preselected temperature. It should be understood that apparatus **10** can be configured with both heating and air conditioning elements to provide year-round climate control of the apparatus.

In another aspect of the disclosure as shown in FIGS. **3**, **3**A and **4**, a conveyor belt driven bottle delivery system provides an additional bottle delivery option that increases the number of bottles storable in the apparatus within a given set of apparatus dimensions. The vending/return apparatus shown generally as **200** includes a modular vending segment **202** and a modular return segment **204**. Making each segment modular facilitates delivery of the units meant to be stationary so as to maximize the number of units that may be carried by a single transporter. The design also improves ease of construction.

It is one aspect of the disclosure to keep the dimensions of the vending machine within "transportable dimensions" to allow transport by rail, box truck, or flat-bed ("low-boy") type trailers. Over the road regulations control the widths and heights of these dimensions and can have significant impact on end-destination costs from their original point of manufacture. it is also to be understood that the design of the vending apparatus for both the "vending" side and the "return bottle" side can be contained within a single enclosure for ease of manufacturing and shipping.

Vending segment **202** includes one or more conveyor belt assemblies **206**, stackable, to receive and vend large bottles of water. The apparatus may be configured to dispense bottles sized from about 1 liter to about 5 gallons. A plurality of frame members **228** supports the conveyor assemblies throughout the apparatus. In a multiple conveyor embodiment as shown in FIG. **3**, a top conveyor **211** is driven by a motor **219** having a geared shaft that engages a geared track formed or attached to a bottom of conveyor **211**. Motor **219** may be a 3 hp 120 v motor with a geared shaft and is controlled by the processor described herein.

A bottle guide **214** is positioned above top conveyor **211** substantially in vertical alignment with a centerline of conveyor **211**. Bottle guide **214** is dimensioned to receive the top ends of bottles carried by conveyor **214** so as to allow free movement of the bottles within the guide, but with sufficient restriction to prevent lateral displacement and tipping of the bottles while travelling on the circling conveyor **211**. Guide **214** may be constructed from 4 inch PVC piping cut along a chord less than the diameter of the piping so as to have a cross-section profile larger than a semi-circle. The inward curvature of the cut piping edges provides an arresting surface that engages a bottom edge of a bottle top lip. The PVC material is sufficiently lubricious to permit the unimpeded movement of the bottles along guide **214**.

Guide **214** may be either suspended from a top of vending segment **202**, or secured to the frame elements. To accommodate different height bottles, guide **214** may be either set to a specific distance from conveyor **214**, or attached to an adjustable series of posts to allow guide **214** to be raised or lowered depending upon the bottle size used for the particular conveyor.

If one or more additional conveyor assemblies are used, such as lower conveyor assembly **215** shown in FIG. **4**, the assemblies are aligned substantially laterally and vertically with top conveyor **211**. A lower bottle guide **213** performs the same function as guide **214** for bottles on lower conveyor **215**. Guide **213** is secured to the frame elements and may be either set at a specific distance from conveyor **215** to accept one bottle size, or adjustable to accommodate a plurality of sizes. The means used to allow adjustability may be telescoping supports, segmented supports and the like.

The conveyors are housed in an enclosed structure made from polymeric material sheets or sheet metal, such as sheet steel **212**. The walls and top are insulated with about 2 to about 3 inches of foam core insulation **226**. Additionally, the floor of the enclosure may also be insulated with insulation **226**. Other insulation materials may be used as are commonly known in the art. To counter freezing conditions, one or more heaters **224** are positioned in vending segment **202** and oper-

ated by the processor that also monitors temperature with a temperature sensor (not shown).

To access the conveyor system, at least two access doors are provided. A lockable service door **218**, situated at a distal end of vending segment **202**, provides access to the conveyor assemblies to load filled bottles. Motors **219** are situated in close proximity to door **218** and include manually operable start/stop controls to enable a user to load bottles onto the conveyor(s) and advance the conveyors to facilitate loading of additional bottles until the entire conveyor assembly is loaded with bottles.

Referring now to FIGS. **23**-**25**A, to allow access for customers, a vending door assembly **209** including door **210** is positioned in a front wall of vending segment **202**. In one embodiment, each conveyor assembly is provided with a dedicated door **210** positioned so as to align a bottom end of the door substantially with a top surface of an adjacent conveyor assembly. Each door **210** is secured to a pair of rails **550** that permit horizontal movement of the door from closed to opened positions. In one embodiment, the doors are configured to open to the left, away from the adjacent return segment **204**. Door **210** may be a double layer of Lexan® (as shown in FIG. **25**A), to provide an added measure of insulation for the door area.

In one aspect of the disclosure, rails **550** extend into a pocket **552** dimensioned to receive door **210** when positioned in an open state. A rubber seal/gasket **566** secured to a perimeter of door **210** ensures a substantially air-tight seal when the door is positioned in a closed state. This ensures that any air conditioning (cooling and/or heating) of the internal atmosphere of apparatus **10** is maintained when door **210** is closed.

To electro-mechanically manipulate door **210**, a door operating assembly **554** includes a linear actuator **556** secured to an inside of the front wall of apparatus **10**. Actuator **556** is electrically connected to the processor and secured to the wall with mounting brackets **558**. Extending laterally from actuator **556** is actuator arm **560**. A distal end of arm **560** is secured to door **210** with door mounting bracket **562**. If needed, a slot **564** is formed on the inside of the front wall to provide a clearance channel for arm **560** to slide and/or retreat and extend within.

Although door assembly **209** may be mounted and secured to the front surface of the front wall of apparatus **10** (with brackets **550** secured to the front surface), use of pocket **552** is an improved configuration as a security means to prevent unauthorized access to apparatus **10**. Operation of door assembly **209** is controlled and coordinated with purchases by the processor as disclosed herein.

Door **210** is configured to be locked electronically. Successful completion of the financial portion of the transaction precedes the door being unlocked via a solenoid, or solenoid-like device controlled by the processor, which then initiates operation of actuator **556** to open and close door **210**. The number of bottles purchased and permitted to be removed from the conveyor is controlled by individual locking yolks secured to each bottle. The processor unlocks each bottle in succession until the purchased number has been taken by the customer. Removal of a bottle can be confirmed by any number of means such as broken light beams, pressure sensors and the like. It is in the spirit of the disclosure that any detection means, known in the art, may be used to ascertain when a bottle has been removed by a customer.

Positioned in close proximity to door(s) **210** is vending shelf **223**. Shelf **223** may be constructed from polished aluminum, or any weather-resistance material, such as fiberglass. Shelf **223** provides an accommodating surface to temporarily hold bottles for a multiple bottle purchase, or for a customer to temporarily place other items, e.g., shopping items, while making a purchase.

Referring again to FIGS. **3**-**4**, return segment **204** is shown as a modular unit attached to vending segment **202**. Segment **204** is essentially an enclosure for receiving used bottles for cleaning and reuse. As each bottle is provided with a serial number, a vendor can keep track of the bottle's use and recycle it after its intended lifespan. It should be understood that although the apparatus is described as vending reusable bottles, the apparatus may also be used with disposable bottles and adjusted to accommodate a variety of sizes of disposable bottles. If the apparatus is structured to vend disposable bottles, return segment **204** can be used to deposit disposable bottles for recycling.

Segment **204** includes a bottle return aperture **216** configured to match the cross-sectional dimensions of the bottles **222** offered in the vending segment. This ensures bottles returned to the return segment are bottles owned by the particular vendor that monitors the bottles with coded unique identification numbers. Bottles offered by other vendors having different dimensions will not be accepted in the return segment **204** and/or will not receive a credit without a properly authorized and recognized identification number.

Referring again and also to FIG. **1**, a sensor, or sensors, (not shown in FIG. **1**) situated inside the chute face acts to sense the delivery of an emptied bottle to commence a credit transaction described hereinbelow. There is a barcoded UID and/or an RFID UID tag located on each bottle that identifies the exact vendor and individual bottle and the code is read by an atypical barcode reader device, or an atypical RFID device. The reading device **17** can be placed inside the chute, or on the surface of apparatus **10** as shown in FIG. **15**.

All "tags" be they barcode or RFID are to be waterproof and abrasive proof so as to survive approximately 40-50 re-uses involving high temperature wash/rinse cycles and constant handling. Once read, the empty bottles slide down the chute **16** and become deposited in the return segment **14**. A return door **18** allows access to the return segment space to retrieve emptied bottles for further processing, refilling, etc. A credit/debit card acceptor **20** provides an electronic interface between apparatus **10** and a customer to process vending/return transactions. The "reimbursement" for the previous purchase of the bottle is not credited to the customer card until the barcode/RDID is identified as one belonging to the proper manufacturer and then "credit" is posted. This process assures against receiving unacceptable bottles from some undesired source. The details of acceptor **20** are described further herein.

Referring back to FIG. **4**, to facilitate deposit of emptied bottles, a chute **217** may be appended to the inside of segment **204** so as to provide a smooth transition from aperture **216**. Aperture **216** may be constructed with a modular frame that can be exchanged with other frames of different dimensions to accommodate differently-sized bottles, such as shown in FIG. **26**.

Situated in close proximity to aperture **217** is one or more sensors **221** for detecting the presence of a return bottle being deposited in segment **204**. Sensor **221** may be any well known in the art including, but not limited to, RFID reader, mechanical, optic, photoelectric, etc. Multiple sensors may be used and positioned to ensure a positive read of a unique identification number positioned on bottle **222**. The identification number may be secured to the bottle in any number of methods including tag, laser engraving, sticker and like methods. Sensors **221** may also be configured and arranged so as to determine the dimensions of the bottle being deposited to ensure the bottle is a vendor bottle.

A further purpose of the sensors is to send a signal to the processor to create a bottle deposit credit as explained more fully below. By reading the unique identification number, one credit transaction is created regardless whether the attempt to deposit the bottle requires more than one try. This ensures a customer receives only one credit per bottle returned.

To enable a vendor to retrieve the returned bottles, a return door **220** is provided to allow access to the inner chamber of return segment **204**. Return door **220** is shown attached to a side wall of segment **204**. Door **220** may also be positioned on a back wall, or a front wall without departing from the spirit and scope of the disclosure.

In an alternative embodiment shown in FIGS. **21**, **22** and **26**, door **220** is configured as a locked door that requires bottle authentication before being unlocked. The door is secured to the face of return segment **14** with spring loaded hinges **569** and includes handle **571** to facilitate door opening. A bar code reader **570** is positioned on a front of return segment **14** to read bar codes secured to vendor water bottles. Reader **570** may be electrically connected to the processor to enable a credit transaction for the return bottle as disclosed herein. The customer moves the bottle into close proximity with reader **570** so that the bar code can be read. If there is no bar code, or the bar code is not recognized by the system, door **220** remains locked.

As shown in FIG. **26**, door **220** may simply include a modular chute opening that conforms to the shape of bottles currently being offered by the vendor. In this embodiment, a successful bar code read sends a signal to a solenoid, or like device to unlock door **220** and allow the customer to deposit the empty return bottle. Sensors in the chute area send a signal back to the processor to enable a credit transaction as disclosed herein.

In an alternative embodiment, door **220** may be combined with a motor-driven bottle feed mechanism to detect and advance the return bottle into return segment **14**. In this embodiment, door **220** includes an electric lock **572**, e.g., a squiggle lock, operated when an electrical signal is received from barcode reader **570**. As shown in FIG. **21**, the general opening shape as well as door **220** is configured to conform to the shape of the vendor's bottles so as not to allow insertion of unauthorized bottles. Once the door is opened, a return bottle is inserted into the opening, a first solenoid-based toggle switch **574** detects the presence of the bottle and sends a signal to the processor to perform the credit transaction. A second toggle switch **576** senses a bottle and sends a signal to a gear motor **578** that operates a rubberized wheel **580** registered against the return bottle. Rotation of the wheel **580** urges the return bottle into return segment **14**.

Referring now to FIGS. **10**, **11** and **12**, a further aspect of the disclosure is shown. In this aspect, vending segment **12** includes a plurality of gravity-feed conveyor assemblies **302** that feed bottles **2** into a substantially orthogonal vending conveyor assembly **332**. This embodiment increases the number of bottles deliverable to a single vending door. The conveyor assemblies in this embodiment may occupy one or multiple horizontal conveyor rows as shown in FIG. **10**. Each row has a dedicated vending door from which customers can retrieve purchased bottles.

In this embodiment, a yoke system **334** (shown in FIGS. **13**, **18** and **19**) secured to a guide bar and cable system urges bottles along vending conveyor **332** toward the vending door.

Referring now to FIGS. **5** and **6**, a bottle advancement assembly and a locking/latch assembly, respectively, are shown that control forward movement of bottles along conveyors **302** onto vending conveyor **332** and allow controlled access to individual bottles when a customer attempts to retrieve a bottle during a purchase. Advancement assembly, shown generally as **300**, includes a pair of locking frames fixed to a pair of conveyor rails **302** that support rollers **304**.

As shown in FIG. **5**, a front advancement assembly, generally referred to as **305**, includes a rotating rod **307** used to urge a forward-most bottle toward the vending door. Rod **307** includes a pair of rollers **318**, preferably rubberized, or made from a polymeric material to enhance contact with bottle **2** to ensure positive grip while urging the bottle forward. Rod **307** is designed to rotate 360° to perform repeat bottle movement functions with each revolution. The process begins with rod **307** in a substantially upward or vertical position as shown in FIG. **5**.

Rod **307** is supported by a pair of substantially parallel support bars **310** and **312** positioned on opposing sides of conveyor **302**. A base of each support bar is affixed to the adjacent conveyor rail via mechanical fasteners **326**, welded joint and like methods. Each support bar includes a bore at an upper end into which a ball-bearing sleeve/bushing **320** is secured to allow free rotational movement of rod **307**. Each support bar also includes an adjustable bracket plate secured to each support bar with mechanical fasteners in a slot formed in each support bar to allow the height of assembly **305** to be adjusted for different sized bottles. Telescoping support bars may also be used for this purpose.

Attached to support bar **312** is motor **322** that connects to an end of rod **307** to rotate the rod when a signal is received from the processor to rotate the rod to advance a bottle. Motor **322** may be a 90° offset gear motor, or any motor suitable to rotate rod **307** with sufficient torque to propel a filled bottle forward.

To assist rod **307**, advance wheel **308** is set in front of, or among rollers **304**. Wheel **308** is comprised of a rubber or like material to provide positive traction when contacting bottle **2**. A roller motor **306** operates wheel **308** to propel bottle **2** forward. Roller motor **306** may be a 90° offset gear motor, or any motor adequate to urge bottle **2** forward toward vending door **210**.

To detect movement and ultimate removal of the forward-most bottle, photocells **324** are positioned on support bars **310** and **312** and aligned to create a beam, which when traversed by bottle **2** breaks the beam and sends a signal to the processor. The processor then accounts for the removed bottle for inventory and accounting purposes.

A secondary advance assembly **303** is positioned distal to forward advance assembly **305** to advance the bottle immediately preceding the forward-most bottle. Assembly **303** includes a substantially identical construction as that of assembly **305** including support bars **310** and **312** with adjustable bracket plates secured with wing nuts or similar mechanical fasteners **326** in slots formed in the bars to allow adjustment for differently-sized bottles. Bars **310** and **312** are attached to conveyor rails with mechanical fasteners, welding or like method. Assembly **303** further includes secondary rod **316** with rubber rollers **318** used to urge a second bottle **2** into the forward-most position previously occupied by the forward-most bottle, now removed.

Each support bar includes ball-bearing sleeve/bushing **320** to allow free rotation of rod **316**. Secondary motor **314** is attached to bar **312** and attached to an end of rod **316** to operate the rod and move it in a rotational path to contact bottle **2**, urge it forward, and then return to a starting position as shown in FIG. **5**. Further advance assemblies are not required as bottles fill the second position when vacated by gravity feed.

Referring to FIG. **6**, an alternative bottle advancement assembly is shown. In this embodiment, a locking/latch

assembly **360** arrests forward movement of bottles on gravity-feed conveyor **302**. On a forward side of assembly **360** is a bottle launch segment **380** that utilizes motor-driven geared rollers **366** and a spring loaded stop plate **374** to provide controlled delivery of bottles onto vending conveyor **332**.

Assembly **360** includes a pair of substantially parallel support bars **356** and **358** positioned on opposing sides of conveyor **302**. A base of each support bar is affixed to the adjacent conveyor rail via mechanical fasteners **376**, welded joint and like methods. Each bar may be constructed as adjustable brackets with a first inner segment **362** having a pin, e.g., a threaded bolt, extending outwardly from the assembly. A second outer segment **364** includes a slot for receiving the pin. The segments have overlapping sections the register against each other and provide the necessary support to impart rigidity to the support bars. With the pin loose, the segments can be adjusted vertically to change the vertical height of the support bars to accommodate differently sized bottles.

Top ends of each support bar may be shaped to conform their collective shape to the cross-sectional profile of a bottle and its associated neck so as to reduce the distance between the support bars and consequently concentrate the force applied to the bottle at the point of contact. Each support bar includes a slot **352** at an upper end dimensioned to receive a restraining rod **378** that arrests movement of the bottles. Rod **378** is secured to an actuator **354** which, in turn, is secured to support bar **358**. Rod **378** pivots from closed to open positions from its point of attachment to actuator **354**. In a closed position, rod **378** rests within slots **352**.

The orientation of restraining bar **378** is controlled ultimately by the processor in communication with actuator **354**. Commands received from the processor operate the actuator to set the position of bar **378** in either a closed or open orientation. When bar **378** is in an open position, the lead-most bottle migrates onto launch segment **380** via gravity feed. Forward movement of the lead-most bottle, and any subsequent bottle that migrates onto launch segment **380**, is arrested by stop plate **374**.

Vendor personnel may also operate stop plate **374** at the front ends of each conveyor row to temporarily arrest forward movement of bottles while the conveyor line is being loaded. It has been discovered that commonly sized 2 inch rollers do not allow fluid movement with cylindrically shaped bottles. Rollers having a 1¼ inch diameter closely spaced provide a more advantageous surface for rolling bottles toward the front end of the vending/return apparatus.

Launch segment **380** includes a series of common rollers **358**. Interspersed between rollers **358** are one or more motorized rollers **366** controlled by the processor. A pair of slots **371** formed on an end of launch segment **380** are dimensioned to receive stop plate **374** which slides vertically within the slots and to ensure proper alignment throughout plate **374** vertical movement. Stop plate **374** may include a pair of tension springs **373** positioned toward each end of plate **374** with distal ends attached to a roll bar **368**. Roll bar **368** includes a gear mated to a gear of a geared motor **370**. Motor **370** is also controlled by the processor.

The operation of motorized rollers **366** and stop plate **374** are coordinated by the processor when a vending command is issued. The process begins with stop plate **374** being transitioned from an up, closed position to a down, open position. In the open position, a top edge of plate **374** is substantially level with the highest points of the rollers so as to allow free movement from the launch segment to the vending conveyor **332**. Once in a down position, rollers **366** are activated to urge a resident bottle off of launch segment **380** and onto adjacent and substantially orthogonally oriented vending segment **332** as shown in FIG. **11**.

In an alternative embodiment, a sheet surface may be used in place of the rollers to facilitate movement of bottles loaded onto the conveyor lines. In a yet further embodiment, the rails may be coated with a lubricous surface treatment and act as support surfaces for the bottles to be placed and allowed to roll or migrate toward the front of the vending/return apparatus.

Referring now to FIGS. **9** and **13**, vending conveyor **332** includes a pair of rails with a plurality of common rollers **382** and a plurality of power rollers **384**, i.e., motorized rollers, secured between the rails so as to allow free rotation of the rollers. Power rollers **384** urge resident bottles toward a front of the vending apparatus toward door **210**. A series of sensors **386** are strategically positioned in the rails to detect the presence of bottles coming from each conveyor **302**. A sensor may be positioned to align with each conveyor **302** to ensure any bottles on the vending conveyor are sensed and accounted for by the processor that receives signals from the sensors.

When a vending transaction is processed, the processor initiates release of a bottle from one of the conveyors **302** onto the vending conveyor **332**. The processor next signals motors connected to, or embedded within, each power roller **384** to begin rotation and urge the resident bottle toward the vending door **210**. A modified power roller **385** may be situated in close proximity to the door end of conveyor **332** that can be controlled and used as a brake to arrest forward movement of the subject bottle **2**. When bottle **2** arrives at the end of conveyor **332**, it migrates onto and depresses a paddle switch **388** that activates the braking function of roller **385** (which occurs by virtue of rotating the roller in an opposite direction toward a back end of conveyor **332**), and deactivates via the processor, or via direct connection, the door lock (not shown) that maintains door **210** in a locked position. The customer can then open the door and retrieve the bottle.

In a further aspect of the disclosure, as shown in FIGS. **10**, **12**, **13**, **18** and **19**, a yolk system **334** may be included to urge bottles on conveyor **332** toward door **210**. The yolk system may be used in conjunction with the rollers of conveyor **332**, or may perform the bottle movement function alone with either a conveyor constructed with rollers, or constructed with a smooth lubricious surface such as polished steel with or without a lubricious coating treatment such as Teflon®.

Yolk system **334** rides along a yolk rail **390** secured to the frame system of the vending segment **12**. Positioned at each end of rail **390** are stops **392** and **394**. Yolk system **334** includes yolk assembly **396**, which includes a yolk frame **398** having shaft housings **400** formed on distal ends. Bearing shafts **402** are secured within each shaft housing **400** and rotate freely within the housings. Attached to each shaft **402** is a yolk wheel **404** each of which rotates freely and registers against opposing sides of rail **390**. In an alternative embodiment. Shafts **402** are fixed to yolk frame **398** and yolk wheels **404** rotate freely about shafts **402**. It should be understood that any combination of rotating shafts and/or rotating wheels may be used to produce the same function, i.e., to allow free movement of the yolk assembly **396** along rail **390**.

Suspended downwardly from a proximal end of yolk frame **398** is yolk shaft **406**. Shaft **406** may be welded to frame **398** or affixed via mechanical fasteners **408**. A horizontal push bar **410** is secured to a distal end of shaft **406**, again via weld or mechanical fasteners **412**. Secured to the front surface of push bar **410** in substantial proximity to extreme ends are rubber stops **414**. Stops **414** provide added cushion and grip when registering against a bottle being delivered to the front of the

vending segment **12**. The spacing of the stops assists maintaining bottles aligned with the direction of motion. As is well known in the art, however, the spacing may be altered to accommodate different sized bottles and different bottle configurations. For example, for cylindrical bottles, stops **414** may be positioned to engage tangential points on the bottle's sides to ensure the bottle does not rotate and drift out of alignment relative to the course of travel towards vending door **210**.

Referring to FIG. **13**, yolk assembly **334** is propelled along guide bar **390** via a geared motor **399** controlled by the processor. A pair of pulleys **398**, positioned on the extreme ends of, and suspended above, the vending conveyor, guide a cable **396** attached to shaft **406**. Signals received from the processor coordinate the position of yolk assembly **344** to receive the next bottle delivered onto the vending conveyor **332** to urge it forward toward door **210**. A photocell **387** detects the presence of a bottle advanced to the front of the conveyor and sends a signal to the processor, which sends a signal to motor **399** to arrest forward movement. Yolk assembly **334** either remains positioned at the front until a new transaction is initiated, or is returned to the backmost position in a "ready" mode for the next transaction.

Referring to FIGS. **7** and **8**, cashless customer interface keypad **208** positioned on a front wall of vending segment **202** (or alternatively, on return segment **204**) provides customers with a means to perform paperless debit and credit transactions to obtain filled water bottles and to return emptied reusable bottles. To secure keypad **208** to the vending apparatus, a mounting plate **452** may be attached to, or integral with, the keypad. It should be understood keypad **208** is connected via hardwire or wireless connection to a central processor that processes information received from keypad **208** and controls operation of the vending/return apparatus.

Keypad **208** includes a credit/debit card reading slot **418** into which a card and attached magnetic strip are inserted to enable the system to read the account information embedded in the strip. An LED display window **456** provides a visual display of alpha-numeric based prompts to inform the customer of the transaction progress. Alternatively, a second display **416** may be included in the keypad to inform the customer whether the credit/debit card has been accepted. A further alternative addition is an acceptable credit/debit card list **458** to give customers advance notice of accepted accounts.

The process begins by having the customer swipe or insert a credit/debit card into the card reading slot **418**. The customer then presses one of the selections for purchase. The shown options include purchase of a five gallon bottle button **410**, a three gallon bottle button **412** and a handicap-access, five gallon bottle button **408**. To that end, one or more conveyor rows in the apparatus are set at a height to facilitate handicap access. These conveyor rows operate in essentially the same manner as the other conveyor rows. Referring again to the button selections, to further enhance the distinction between the button choices, each can be colored coded with a different color. Of course, each button may be customized to identify any particular size bottle and more buttons may be added to reflect the bottle size choices offered. By way of example and not limitation, a dedicated button can be included for three gallon handicap access, one gallon bottle, one gallon handicap access bottle, etc.

The customer next selects the number of bottles of the selected bottle size the customer wishes to purchase by pressing one of the numeric keys **414**. The illustrative examples shown in FIGS. **7** and **8** show six numerical key options. The interface keypad may be constructed with more or less numeric key options. Once a selection number has been made, the customer is prompted on LED screen **456**, or by audio prompt to open one or more specified vending doors to retrieve purchased bottles.

If return bottles are to be added to the transaction, a return bottle button **468** is depressed by the customer. The customer then exposes a barcode, or other similar marking methodology, attached to the return bottle to a barcode reader **402**. Once a bottle's bar code has been successfully read, the customer is prompted visually and/or audibly to open return door **220** and insert the bottle being returned. In an alternative embodiment, return door **220** may be substituted with a return slot dimensioned to receive bottles of the sizes offered in the vending apparatus.

To ensure proper credit, the apparatus does not allow the customer to return additional bottles until the bottle previously scanned is successfully deposited in return segment **204**. Each successive return bottle has to be properly and successfully scanned before being deposited in the return segment in order to receive the desired credit for the return. Additional matters involving return bottles are described more fully hereinbelow. Once the last return bottle is processed, or if not return bottles are involved in the transaction, the customer may depress an optional sale complete button **420** to enable the vending system to tabulate the debits and/or credits and finalize the transaction. An application to process sales and return transactions is disclosed more fully below.

In a yet further embodiment of the disclosure, a vending elevator is provided to further increase the number of bottles storable and deliverable in a single apparatus. The apparatus includes a plurality of columns and rows to maximize bottle storage and delivery. As used herein, a column shall mean a vertical assembly of bottles supported by dedicated platforms, and a row shall mean a horizontal support for receiving and holding a plurality of bottles, or other desired objects.

As shown in FIGS. **15** and **16**, combined vending/return apparatus **10'** (elements bearing primed reference character numbers correspond to elements bearing unprimed numbers), includes a combination of stacked gravity fed vending conveyors that merge onto substantially horizontal launch segments **380** used to initially arrest forward movement of each bottle advanced on the gravity feed conveyors **302'** (5 gallon bottle conveyors) and **303'** (3 gallon bottle conveyors). More specifically, launch segments **380** each include motor-driven conveyor belts **507** driven by dedicated computer-controlled conveyor motors **506**. When activated, conveyor belts **507** urge bottles present on the conveyor belts onto a delivery elevator **500**.

Elevator **500** is connected to one or more linear actuators to position elevator **500** to receive bottles from launch segments **380** and to position received bottles into a proper location for bottle removal by a customer. As shown in FIG. **14**, a first linear actuator motor **510** is connected to a lead screw **520** that controls elevational movement of elevator **500**. Elevator **500** is connected to an anchor **522** having a threaded through-bore for receiving lead screw **520**. Depending on the orientation of the threads on lead screw **520**, forward and reverse modes of operation of motor **510** with either raise or lower elevator **500** to desired positions within apparatus **10'**.

In one aspect of the disclosure, elevator **500** is combined with outgoing conveyor **332** to bring bottles from multiple rows and columns to vending door **210**. In this aspect, conveyor **332** is configured substantially as shown in FIG. **6**. The coordination of launch segments **380**, conveyor **332** and elevator **500** is performed by the resident computer processor disclosed herein. When a customer makes a purchase selection, the computer process determines from which row and

column a bottle should be retrieved and operates launch segment **380**, conveyor **332** and elevator **500** to retrieve and deliver the selected bottle.

In another aspect of the disclosure, elevator **500** is not combined with outgoing conveyor **332**. Instead, elevator **500** is connected to a second linear actuator to move along a second horizontal axis. As shown in FIGS. **17** and **20**, elevator **500** is connected to lead screw **520**, which is driven by overhead mounted motor **527** to effectuate vertical movement of elevator **500**. Lead screw **520** is further connected to horizontal anchor **531** that includes a threaded bore to receive a second lead screw **521** and a through-bore and bushing for receiving lead screw **520**. Lead screw **521** is operated by attached horizontal motor **530**.

To enable horizontal movement of elevator **500**, a lower track **523** having a cross-sectional shape of a flattened "u" is configured to receive actuator roller wheels **525** secured to a lower end of lead screw assembly **520**. To secure an upper end of lead screw assembly **520**, slide bar **390** is positioned to extend substantially along a top end of the apparatus' sidewall to guide horizontal movement of the vertical lead screw assembly. Yolk assembly **334** (shown more particularly in FIGS. **18** and **19**), has motor-driven wheels **529** that propel lead screw assembly **520** along slide bar **390**. Both lead screws may be operated simultaneously or serially to align elevator **500** with a specific column and row location and/or align the elevator with access door **210** at an outgoing vend position **501**.

In a yet further aspect of the disclosure as shown in FIGS. **28**, **29** and **30**, an integrated vending/return apparatus **10** includes a series of stacked gravity fed vending conveyors having open front ends to permit delivery of individual bottles from a single exit point, and a return bottle conveyor superposed about the vending conveyors along a perimeter of the apparatus. This configuration minimizes the amount of space necessary to perform bottle vend and return functions from a single, streamlined, simplified and integrated unit. This embodiment further substantially reduces the number of operating parts needed to perform the desired functions.

In this embodiment, apparatus **10** includes a plurality of stacked conveyors **302"** constructed from paired rails (as shown in FIG. **5**) between which are secured a plurality of rollers **304** that allow water-laden bottles to move freely toward a front end. In an alternate embodiment, Teflon® coated slick-rails may be used rather than rollers. The stacked rows can be contained within a number of columns aligned along the width of the apparatus as shown in FIG. **29**. Each water bottle delivery conveyor extends from a back wall—having an access door **217** to load the conveyors—to a point short of the apparatus front wall. The distance between a front end of the conveyors to the front wall is greater than the bottle size used in the apparatus.

To access the vending conveyors from the exterior, a full swing door **218'** is secured to a back wall of apparatus **10**. Both door **218'** and door **217** have to be opened to provide access to vending conveyors **302"**. To access the vending conveyors, return bottles **3** must be removed from apparatus **10**.

To return bottles, a customer exposes a bar code on the return bottle to the bar code reader **17** that sends a signal to the processor to unlock return door **590**. The customer places the bottle in the upper conveyor return channel to return the bottle. A sensor positioned in close proximity to the front opening ensures the bottle is inserted into the return channel before a credit is given. Although the return channel is sloped to urge return bottles **3** towards the back of the apparatus, a front radius ramp **591** may be used to prevent return bottles from inadvertently spilling out of the front end of apparatus **10** before door **590** is returned to a closed position.

To ease the movement of return bottles along the upper return channel and down a substantially vertical connected channel as the back of apparatus **10**, a radius **595** may be formed at the juncture of the return channel and the vertical channel. To further ease movement of the return bottles a second radius **593** may be formed at a bottom outside corner formed by the junction of the vertical channel and a bottom return channel. The bottom return channel is sloped toward the front of apparatus **10** to urge return bottles **3** toward the front of the apparatus.

To retrieve return bottles, a front unload door **592** is secured to the front wall of apparatus **10** to provide access to the bottom return channel. For ease of use, unload door **592** is hinged at a bottom edge to allow the door to function as a ramp and to allow gravity to keep the door open while return bottles **2** are removed. Due to the structure of the return bottle channels, the entire insertion and removal procedure may be achieved without the use of power-assisted rollers as gravity provides the necessary force to urge the bottles to the front of apparatus **10** adjacent to unload door **592**. In an alternative embodiment, a radius may be formed at the front end of the bottom return channel to prevent bottles from spilling out of apparatus **10** when unload door **592** is opened.

To ensure the slope of each conveyor is set properly, leveling feet **38** are provided on a bottom of apparatus **10** to ensure the apparatus' casing is level and square. The slope of the conveyors are set relative to the plane occupied by the bottom or floor of apparatus **10**.

To retrieve a full bottle, a customer has to operate credit card acceptor **20** as described herein. Once the credit transaction and number of bottles are approved, the processor operates a radius door **594**. Radius door **594** is secured to a welded rod **601**. One end of rod **601** is secured to a pillow bearing **602** and the other end is secured to gear motor **600**. Motor **600** is operated by the processor. In one embodiment, a shelf basket **598** is secured to the front of apparatus **10** below the lowest point of door **594** when in an open position. When a bottle is purchased, door **594** rotates open. The radius of the door, conformed to the shape of the bottle, cradles the bottle until retrieved by the customer. With the embodiment employing basket **598**, a purchased bottle exits apparatus **10** via gravity and comes to rest in basket **598**. The basket shelf has openings between rails that provides further access points for a customer to remove the purchased bottle from apparatus **10**.

In a yet further embodiment, a retractable, substantially horizontal slide door **597** may be secured to a front end of the second highest vending conveyor **302"** to prevent full bottles from collapsing on bottles being vended from the primary of lowest vending row to which door **594** is aligned. Door **597** is secured to an actuator that can retract the door when the primary vending row is depleted of full bottles. The processor either receives a signal, or does not receive a signal from a sensor placed in the primary vending row to indicate an empty row status. Once this signal, or absent signal is received, the processor sends an "open" signal to the actuator to open door **597** to allow the migration of one bottle onto the primary vending row for delivery to a customer. Door **597** is closed after a single bottle is released to ensure additional bottles do not collapse on the bottle to be delivered to the next customer.

As with the other disclosed embodiments, this embodiment includes solar-powered vents **524** that operate continuously to adjust pressure and temperature with the heating and/or cooling units. A series of lights **596**, e.g., fluorescent, may be secured to an eaves of the apparatus' top to provide

adequate lighting and added security during night time purchases. Consistent with the other embodiments, this embodiment also includes credit card acceptor **20** positioned on the front wall of apparatus **10**. Credit card acceptor **20** may also be positioned on a sidewall depending upon the orientation of apparatus **10** relative to surrounding structures, e.g., a grocery store.

In a yet further aspect of the disclosure, integrated vending/return apparatus **10** shown in FIGS. **28-31** may be modified to include shortened vending rows to allow front loading of full bottles. As shown in FIGS. **32** and **33**, vending apparatus **10** includes a plurality of conveyors to receive and vend bottles. The rows may be sloped purposefully to allow gravity to urge bottles in a desired direction. As with other gravity feed embodiments, sloped conveyors may be substituted with substantially level conveyors having power rollers as described herein, or a combination of both.

As shown in FIGS. **32** and **33**, apparatus **10** includes a series of stacked conveyors **302"**. An uppermost conveyor is dedicated to receive return bottles using door **596** as an access way. As with the prior embodiment, the uppermost conveyor includes a radiused transition **595** to a substantially vertical wall that in part defines a substantially vertical return bottle channel connected to a lowermost conveyor that leads to access door **592**. As with the prior embodiment, door **592** allows return bottles **3** to be retrieved by the vendor.

To ensure the return bottles travel in the correct direction, the uppermost conveyor is configured with a downward slope going from a front end to a back end of apparatus **10**. The lowermost conveyor is configured with a downward slope going from a back end to a front end of apparatus **10**. To prevent return bottles **3** from becoming impinged at any of the conveyor transition points, radius **595***a* and **599** may be formed at the junctions. It should be noted that in this embodiment, the back wall of apparatus **10** as well as the back wall of the vending conveyor segment do not include doors. The vending conveyors are completely isolated from the return conveyors.

With respect to the vending conveyors, two or more conveyor rows are stacked as shown in FIG. **32**. A topmost vending conveyor extends from a front wall of apparatus **10** to a point distal to a back wall of the vending conveyor segment. The distance between the end of the uppermost conveyor and back wall is dimensioned to allow filled bottles to migrate freely from the uppermost conveyor to one or more lower rows of vending conveyors. The uppermost vending conveyor is configured with a downward slope going from a front end to a back end of apparatus **10**. This ensures filled bottles travel to the end of the uppermost vending conveyor and down onto the stacked vending conveyors.

With the exception of the uppermost vending conveyor and the lowermost vending conveyor, each intermediate vending conveyor in this embodiment extends from a point distal to the front wall of apparatus **10** to a point dimensionally similar to the end point of the uppermost vending conveyor. The distance between the front end of the intermediate vending conveyor and the front wall is sufficient to allow filled bottles to travel freely from the intermediate row to the lowermost vending conveyor row. This ensures the free flow of filled bottles along the entire length of the vending conveyors.

With the exception of the uppermost vending conveyor, each vending conveyor, including the lowermost conveyor, is configured with a downward slope going from a back end to a front end of apparatus **10**. This ensures bottles **2** move toward the front of apparatus **10** via gravity and/or power roller feed.

The lowermost vending conveyor extends from a front end of apparatus **10** to the vending conveyor segment back wall. Radius **595***a* ensures bottles **2** travelling from the uppermost conveyor will flow freely and smoothly onto the lowermost vending conveyor and toward vend door **594**. Like the prior embodiment, apparatus **10** may include a basket **598** to present purchased bottles **2** for retrieval by a customer.

The methods used to return empty bottles **3** and to purchase filled bottles **2** via acceptor **20** is the same as any of the other embodiments disclosed herein. As with the other embodiments, vending doors **594** and return doors **596** are electromechanically locked and unlocked to disallow and allow access, respectively.

To load this embodiment with filled bottles **2**, a vendor unlocks and opens fill door **604**. In this embodiment, each column in apparatus **10** has a dedicated fill door **604**. Bottles are inserted through the door and allowed to travel down the uppermost vending conveyor and to travel down to the lowermost vending conveyor. Once the lowermost vending conveyor is full, the next successive bottle will contact the last bottle in the lower most vending conveyor row and migrate onto the lowest intermediate vending conveyor row until that row is filled as well. The process is continued until each successive intermediate vending conveyor row is filled followed by the uppermost vending conveyor row.

When a purchase is made, the bottle closest to door **594** travels off the front end of the lowermost vending conveyor for retrieval by the purchaser. The filled bottle immediately behind or above the vended bottle will move into the first position adjacent the now closed door **594**, ready for the next purchase. A rotating stop rotates into an upward position to arrest movement of the bottle adjacent to the bottle being vended. The rotation of the stop is coordinated with the rotation of door **594** to an open position. When rotating to a closed position, the stop rotates to a down position to allow the next bottle to migrate to the first position via gravity. A similar stop may be positioned at a front end of the row above the vending row to arrest downward migration of bottles from the upper row into the vending position.

In another aspect of the disclosure as shown in FIGS. **27***a* and **27***b*, a bottle vending application is shown generally as **100**. The application begins with the customer approaching and operating the vending machine terminal **104**. Terminal **104** is configured to receive credit/debit cards and/or prepaid purchase cards **102** purchased from the retailer adjacent the vending apparatus. Depending on the configuration, the customer touches or slides the card in the reader at step **106**. If the attempt to engage the reader is unsuccessful, the customer is prompted to try again after a predetermined time period to read the card information lapses. The system may be configured to allow for a predetermined number of tries to have the card read before the system declines to read the card.

If the card is read successfully with the first attempt, or any successive attempt, the system performs a credit check by logging onto the credit card company's website at step **108**. If the credit check returns a negative result, the system rejects the card at step **110** and informs the customer with a visual and/or audible prompt to retry entering the card. The system may be configured to allow a predetermined number of tries to retry the card and receive a positive credit check result.

If the customer retries the same card up to the predetermined allotted tries and receives the same negative result, the system prompts the customer to try another card at step **112**. The customer can either go or return to the retailer to purchase a prepaid card, or have a defective prepaid card replaced, and try the new or replaced prepaid card. Alternatively, the customer can use a different credit/debit card and engage the card

reader at step **106**. The presence of a new card resets the predetermined number of tries to either read and/or verify positive credit at steps **106** and **108** respectively.

Once a credit check result is positive, the customer is prompted to purchase water at step **114**. To ensure the vendor does not give out credits for third party bottles or for bottles retrieved from prior customers without subsequent purchases, the choice is limited initially to a purchase transaction. The system allows customers the option to obtain credit after the purchase portion of the transaction has been completed as disclosed below. Thus, the first purchase by any customer results in the cost of the bottle being borne by the customer. The customer can also re-sell an empty bottle back to the creditor by purchasing additional units and returning emptied bottles. Thus, a customer may choose to buy only one bottle and leave without a return, or upon a subsequent purchase return the empty from a previous purchase.

In one embodiment, the customer is given the option to select 3-gallon bottles at step **116**, 5-gallon bottles at step **118**, or a combination of the two by selecting the combo option at step **120**. With respect to a vending apparatus incorporating an elevator delivery shelf, the bottles are delivered at approximately a 30 inch height to ensure handicap access. In another embodiment, wherein there are multiple vending doors at different heights, the customer is prompted to select whether the bottles to be delivered require handicap access at step **122**. If yes, the vending apparatus discharges purchased bottles from a lower door rather than a higher door. The customer next selects the number of bottles to be purchased in the transaction at step **124**.

Once the number (1 . . . n) and size of bottles have been selected, the system processor selects the column from which the bottles will be distributed at step **126** so as to select the first available bottle in a specified row, which represents the oldest bottle present in the vending apparatus. The system processor next selects the row from which the purchased bottles will be delivered at step **128** and activates the motor associated with the particular row until the correct number of bottles purchased has been fed into the vending segment of the vending apparatus. The system then enacts a data selection control to ensure proper alignment of purchase request and vended bottles.

Once a bottle is selected for vending at step **132**, the vending apparatus starts the offloading to conveyor process. The processor then selects the row at step **134** and activates the outgoing conveyor motor and operates the elevator to position it to the correct row at step **136**. Once the elevator is in the correct position, the outgoing conveyor loads the elevator to vend the bottle at step **144**. If the elevator is not loaded, the processor prompts the customer to push a reset button at step **146**. The processor then returns to the select row step **134**, and again activates the conveyor motor and operates the elevator if not in the correct position relative to the selected row. If either the conveyor motor fails to operate, or the elevator is not positioned correctly relative to the selected row for a second cycle, i.e., a vend failure, or the bottles are in a sold out condition determined at step **138**, the processor prompts the customer to call a toll free number for a 24/7 service line at step **140**. The customer then reports the problem to a dispatcher for service at step **142**.

If the outgoing conveyor successfully loads the elevator to vend at step **144**, the processor operates an automated window to open it at step **148**. The customer can now remove the selected bottle from the vending apparatus. If the door fails to open, the processor returns to the reset step **146**, which either attempts the cycle for a second time, or directs the customer to call the dispatcher if the failure is a second cumulative failure. The row selection, conveyor operation, elevator operation, and door operation cycle is repeated for as many bottles as are purchased.

The system then determines if all purchased bottles have been removed successfully from the appropriate vending window at step **150**. If not, the system returns, repeatedly if necessary, to step **148**. The system next prompts the customer to confirm whether the water purchase is complete at step **152**. If the customer decides to purchase additional bottles at step **154**, the system returns to step **114** to allow the customer to select additional bottles. If the customer decides not to purchase additional bottles, the system asks the customer whether the customer wishes to return any empty bottles at step **153**. If no, the customer is prompted to push an "End" button and request a printed receipt at step **156**. The credit card company processes the transaction and sends instructions back to the system that prompt the system to print a receipt at step **158**. The receipt is removed and the transaction completed at step **160**.

If the customer selects returns at step **153**, the system goes to the return bottle cycle at step **162**. The customer is prompted to scan a UPC and/or barcode, RFID marking/label at step **164**. If the system fails to read the code, the customer is prompted to check the barcode label to determine if it is clean and readable at step **166**. The customer is then prompted to try to rescan the code at step **168**.

If the scan is successful at either step **164**, or upon retry at step **168**, the system determines if the return bottle is a "vendor approved" bottle at step **170**. If not, the customer is asked whether this is the last return bottle at step **171**. If yes, the system goes to **156** and prompts the customer to push the "End" button to begin the final transaction sequence. If not the last return bottle, the system returns the customer to step **162** to begin the next return bottle cycle.

If the bottle is determined to be a vendor approved bottle at step **170**, the return bottle window opens at step **172**. The customer then inserts the bottle in the correct geometric orientation to match the geometric configuration of the return bottle window opening at step **174**. If the bottle is successfully inserted, a switch/activator with motorized roller is activated at step **180** to eject the bottle into the return bin at step **178**.

If the bottle is not properly inserted into the return bottle window, the customer is prompted to retry at step **176**. If successful, the switch/activator is activated at step **180**. If not, the customer is directed to call the toll free 24/7 service number at step **138**. If the problem is not resolved, the customer is next asked if there are any other return bottles at step **177**. If yes, the system returns to step **162**. If no, the system goes to step **156** to complete the transaction.

If the bottle is successfully deposited into the return bin, the processor validates that the bottle has been properly inserted at step **182**. If no, the system returns to step **180** to begin the insertion process again. If yes, the system verifies the "serialized" UPC and/or RFID code of the 3 or 5 gallon bottle return at step **184**. If verification is not successful, the system rechecks the code at step **186**. If the code isn't verified, the system cancels the original UPC code scan and sends the customer back to step **162** to start the return process again. If the code is confirmed at step **188**, the system queries the customer whether the processed return bottle is the last bottle at step **190**. If no, the system returns the customer to step **162** to begin processing the next return bottle. If yes, the system combines the debit and credit transactions to arrive at a net sale at step **192**.

If the customer uses a pre-paid card to pay for water and has returns, the customer may simply return the bottle as usual and the "prepaid water card" will be reimbursed for the trans-

action as if the customer had "paid additional funds"—similar to a prepaid "transit card" whereby the card can be "recharged by putting it back into a transit card machine and paying additional money. The system controller issues a net statement of transaction at step **194**. The customer is now queried as to the correctness of the amount at step **196**. The system receives the customer's verification input at step **198**. If the amount is disputed, the system prompts the customer to contact the credit card company at step **200**. The customer is given a toll-free number to the credit card company at step **202**.

If the amount is correct, the system issues a statement of the net transaction to the credit card company at step **204**. The charges are processed by the credit card company and transmitted to the vendor's account at step **206**. Once the system receives verification that the transaction has been completed with the credit card company, the customer is prompted to push an "END" button at step **208** to end the transaction. The system prints a receipt and the transaction is completed at step **210**.

In a still further aspect of the disclosure, a unified bottle vend/bottle return apparatus, shown generally as **620** in FIGS. **36** and **87**, is configured to receive return bottles **3** and vend full bottles **2** using the same conveyor track assemblies. This embodiment incorporates a series of gravity-fed conveyor track assemblies arranged in alternating grade orientations with each conveyor track set to a precise grade range and coupled with a series of strategically-positioned inertia restriction devices to accommodate both full and empty bottles in a wide variety of commercially available sizes. The combination of conveyor track assemblies and inertia restrictors enables a gravity fed conveyor system to advance bottles to a vending segment without the need of power assistance.

In its broadest aspect, a power-actuated cradle receives empty return bottles and delivers them to the conveyor system. A power-actuated elevator receives filled bottles from the conveyor system and elevates the bottles to a universally accommodating height for customer retrieval. A series of sensors monitors return bottles and full bottles to ensure proper receipt of vendor-accepted empty bottles and proper delivery of full bottles from the supply stored on the conveyor system.

In this embodiment, return bottles **3** are loaded into the apparatus via a return door **622** having a solenoid-actuated lock **623**, such as an Eaton solenoid interlock (Eaton Corp., Windsor, Conn.). A door lock sensor **625** which may be in the form of an Eaton limit switch may be used to detect door orientation status. Lock **623** is disengaged by receiving a signal from the processor when a customer has initiated a vend event.

Once return door **622** has been opened, the customer may be confronted by a form configured in the shape of acceptable return bottles positioned inside door **622** on a plane orthogonal to the plane occupied by the door. It should be understood that the form is an optional element that can be removed without compromising the function of the apparatus. Its use, however, should improve reception of vendor-approved empty bottles **3**. When used, the form provides a visual and physical alignment system to ensure customers orient the return bottles in one orientation to allow the sensors to determine if the bottle is a vendor accepted variety. Once a return bottle is placed into the form, the bottle falls onto a bottle cradle **624**. Bottle cradle **624** receives return bottle **3** and allows for sensors to ascertain whether return bottle **3** is a vendor approved bottle subject to a credit transaction. If approved, cradle **624** is rotated to urge the bottle onto a first track assembly **640**.

More specifically as shown in FIGS. **48** and **49**, cradle **624** is configured as a partial cylindrical segment to substantially conform to the basic shape of the vendor-approved round bottles. The complimentary shape of cradle **624** allows return bottles introduced into apparatus **620** to loosely nest in the cradle so as to become stationary. A front edge of cradle **624** is secured to a rotatable axle **626** the ends of which are secured in bearing mounts **628** to allow rotation of the axle. A "c-axis" motor **630** is connected to one end of axle **626** to provide a means to rotate the axle and attached cradle. Motor **630** may be a Molon 24v gear motor (McMaster Carr, New Brunswick, N.J.).

To determine if a bottle placed in the return bin is a vendor approved bottle, a series of sensors are strategically placed in the return bin segment to sense and retrieve the data necessary to make the determination. An optional empty bottle back rest **632** is secured to and extends from axle **626** so as to substantially align with the center axis of cradle **624**. Back rest **632** ensures proper horizontal alignment of a return bottle to allow for transmission of the return bottle further into the apparatus.

A first sensor **634** is positioned relative to cradle **624** to sense the length of return bottle **3**. A second sensor **636** senses a second length of the bottle so as to distinguish between 3 gallon and 5 gallon bottles. Two outside diameter sensors, **637** and **638**, are used to determine bottle diameter to ensure a vendor-approved bottle has been deposited in the return bin. The O.D. sensors are positioned on either side of cradle **624** (as shown in FIG. **49**), to ensure any bottle placed in the return bin will be detected and identified. Eaton limit switches, which require mechanical registration with triggers may be used for this purpose. (Eaton Corp., Windsor, Conn.).

Each sensor determines length relative to a back rest **632** used as a reference point. If neither sensor is tripped, the return bottle is rejected and the customer is instructed to remove the bottle with a prompt described below. If a valid bottle is detected, the customer is given the designated credit and the system sends a signal to motor **633** to rotate cradle **624** to propel return bottle **3** onto first track assembly **640**. A cradle limit switch **636** is used to determine when cradle **624** has rotated sufficiently to propel empty bottle **3** onto track assembly **640** described below. Mechanical registration against the trigger of limit switch **636** sends a signal to the processor, which sends a signal to motor **633** to reverse and return cradle **624** to a start position, ready to receive another empty bottle **3**.

To control the travel velocity of return bottle **3**, an arrestor flap **638** creates drag to offset the kinetic energy imparted to return bottle **3** by the rotation of cradle **624**. Arrestor flap **628** also provides a secondary function by acting as a barrier to weather related elements entering the apparatus from the return bottle segment.

To the inventors' surprise, the use of the same track assemblies to vend filled bottles and receive empty bottles required specific track assembly configurations and selectively placed inertia retarders to ensure continuous aligned travel of each bottle to forward positions regardless of the wide disparity in weights and moments of inertia prevalent with bottles having different sizes and different fill conditions. The specifics of those findings are as follows.

First track assembly **640** is positioned to the side of cradle **624** as shown in FIG. **36**. Assembly **640** employs a series of tracks and asymmetric rails to accommodate bottles having asymmetric longitudinal cross sections due to the bottle necks presenting a different cross-sectional profile than the bottle bottoms. As shown more particularly in FIGS. **39-41**, track rails **642** are substantially parallel and spaced to match the spacing of annular channels formed on the outside of the

bottles. Rails **642** may be coated with a lubricous surface treatment such as Teflon® to reduce frictional resistance of bottle travel. Rails **642** may be constructed from steel, iron-based materials, engineering-grade plastics and the like. Bottles introduced into the apparatus travel along track rails **642** by engaging the rails with the annular channels. This interaction assists in the alignment of the bottles as they travel along the track system.

Track rails **642** are secured to support plates **644**. A single support plate **644** may secure both rails to the apparatus, or two plates may be used, each dedicated to a single rail. Support plates **644** are secured to rail support beams **645**, which lie substantially below track rails **642** and are intersected by substantially orthogonally oriented cross beams **646**. Cross beams **646** are secured, in turn, to the apparatus' internal framework—including vertical frame members **643**.

To further assist the alignment function of track rails **642**, a pair of asymmetrically positioned guide rails are provided on either sides of the track rails to prevent lateral migration of bottles as they move along the rails, or while the bottles remain stationary waiting for further advancement along the rail system as bottles are purchased and removed from the apparatus. More specifically, neck rail **648** is positioned on the side of track rails **642** that receives the bottle neck portion of the bottles. Neck rail **648** is secured to rail support beam **645** by a plurality of rail connectors **650** that extend laterally from beams **645**. Connectors **650** have an elbow-shaped profile and extend upwardly above the plane of track rails **642** to support neck rail **648** above the track rails.

To ensure the smooth flow of bottles along neck rail **648**, the end of rail **648** proximal to the cradle **624** may have a radiused curve **649** that extends laterally so that the proximal end is joined to the apparatus frame. A distal end of the rail is bent into a circular shape that extends downwardly past and below the end of track rails **642**. When a bottle is thrust onto track assembly **640**, rail **648** presents a smooth surface to transition and urge the bottle to an aligned position on track rails **642**.

To prevent lateral migration of the bottles from the bottom end side of the bottles, bottom guide rail **656** is positioned above, and lateral to, track rail **642** on the side opposite neck rail **648**. Do to the substantially planar surface of the bottle bottom surface, bottom guide rail **656** is positioned higher than neck rail **648** to provide better support for the relatively larger bottom surface. Bottom rail **656** may be positioned to contact the bottles throughout their travel along track assembly **640**, or may be positioned to leave a relatively small gap between the bottle and rail to reduce or eliminate frictional resistance to bottle movement.

In an embodiment where bottom guide rail **656** is positioned toward the back of the apparatus, rail **656** is secured directly to the apparatus frame rather than rail support beam **645** as shown in FIGS. **40** and **41**. Alternatively, bottom guide rail **656** can be connected and supported by rail support beam **645** with the use of rail connectors as used for neck rail **648**. An end of bottom rail **656** proximal to cradle **624** is secured to the apparatus frame via welding, mechanical fasteners and the like. It may be secured directly to a frame member, or separated as its positioning may require. It can end as a blunt rod, or include a radiused curve to provide a smooth transitional surface to receive a bottle pushed onto track assembly **640** by cradle **624**.

It should be understood the orientation of the guide rails relative to the apparatus is dictated by the orientation of the bottles placed on the conveyor system. In an alternative embodiment, the necks of the bottles can be oriented toward the back of the apparatus whereby the guide rails are reversed with the neck rail positioned toward the back of the apparatus and the bottom rail positioned toward the front of the apparatus. Either configuration should be well within the contemplation of this disclosure and fully understood by those having ordinary skill in the art.

As shown in FIGS. **39** and **41**, an inertia restrictor support beam **658** is secured above track assembly **640** to support inertia restrictors **660**. Beam **658** is secured to the apparatus via cross beam **646** and supported at a distal end by cross rod **662**. Cross rod **662** is positioned on, and secured to vertical frame member **643** to align cross beam **646** in a substantially parallel orientation to the plane occupied by track assembly **640**. Suspended from beam **658** are inertia restrictors **660** that include brush-like bristles **664** configured and positioned to contact bottles and reduce the inertia of bottles traveling past the restrictor as well as to align empty bottles with track assembly **640**. Bristles **664** may be constructed from synthetic materials that exhibit little or no movement memory so as to return to a start position after flexing from the force imparted by a passing bottle. To provide further control over the amount of inertia restriction imparted onto the bottles, one or more inertia restrictors may be secured to beam **658** via hinge **666**. Hinged restrictors as shown in FIG. **39**, allow additional resistive force to be applied to bottles without halting forward progress of the bottles based upon gravity driven motion.

Location of the inertia restrictors **660** is driven by a need to align empty bottles as they travel along the conveyor path. It has been discovered that placement of inertia restrictors is particularly advantageous if placed at or in close proximity to the end of a track assembly such as track assembly **640**. This allows sufficient kinetic energy to be drawn from the empty bottle to allow a smooth transition to a lower track assembly when the bottle enters radiused track assembly transition guide rails **668**. As can be seen in the drawings, once in the transition guide rail area, the bottle experiences a moment of free fall that dramatically increases its kinetic energy that is, in part, imparted to the immediately preceding bottle. An additional inertia restrictor **660** may also be secured at, or in close proximity to, the beginning of a track assembly to reduce the kinetic energy generated in the transition area. Further inertia restrictors **660** may be located along a track assembly spaced approximately two bottle widths apart. More inertia restrictors may be placed on the lowest most track assembly as that is where kinetic energy buildup is greatest. However, it has been found that inertia restrictors are needed more on the intermediate track assembly levels than the first level due to the buildup of kinetic energy. It has been further discovered that no inertia restrictors are needed on the fourth and final track assembly as the assembly is filled with full and empty bottles at all times such that bottles on this track assembly only move in incremental, one-bottle diameter distances at a time.

A particularly robust inertia restrictor **660***a* (similar to inertia restrictor **660'** shown in FIGS. **75** and **76**), may be used at, or in close proximity to, the proximal end of track assembly **640** to absorb the relatively large amount of kinetic energy imparted on empty bottles urged onto the track assembly by cradle **624**. Inertia restrictor **660***a* may be constructed as a solid hinged panel that rotates with the force exerted by an empty bottle being urged onto track assembly **640**. Inertia restrictor **660***a* returns to its resting position either via gravity and/or spring actuated means.

Referring now to FIGS. **42-44**, second track assembly **640'** is shown positioned below first track assembly **640**. Second track assembly **640'** is constructed from substantially the same components as first track assembly **640** with the notable

exception the leading end of the second track assembly has substantially the same radiused or turned bottle rail guide ends as its trailing end. This substantially mirror image configuration conforms with one of the primary purposes of second track assembly **640'** as a transitional track assembly that allows bottles, filled or empty, to transition from the first track assembly to lower track assemblies and ultimately, to elevator **702**. And, of course, the slope or grade of second track assembly **640'** is opposite that of first track assembly **640** to continue the gravity assisted migration of bottles from the high point of first track assembly **640** to the end of a fourth track assembly **640'"** described below.

More specifically, second track assembly **640'** comprises second track rails **642'** configured to be substantially parallel and spaced to substantially match the spacing of the annular channels formed on the outside of the bottles. Rails **642'** may be coated also with a lubricous surface treatment such as Teflon® to reduce frictional resistance of bottle travel. Rails **642'** may be constructed from steel, iron-based materials, engineering-grade plastics and the like. Bottles introduced into the apparatus travel along track rails **642'** by engaging the rails with the annular channels. This interaction assists in the alignment of the bottles as they travel along the track system.

Track rails **642'** are secured to support plates **644'**. A single support plate **644'** may secure both rails to the apparatus, or two plates may be used, each dedicated to a single rail. Support plates **644'** are secured to rail support beams **645'**, which lie substantially below track rails **642'** and are intersected by substantially orthogonally oriented cross beams **646'**. Cross beams **646'** are secured, in turn, to the apparatus' internal framework—including vertical frame members **643**.

To further assist the alignment function of track rails **642'**, a pair of asymmetrically positioned guide rails are provided on either sides of the track rails to prevent lateral migration of bottles as they move along the rails, or while the bottles remain stationary waiting for further advancement along the rail system as bottles are purchased and removed from the apparatus. More specifically, neck rail **648'** is positioned on the side of track rails **642'** that receives the bottle neck portion of the bottles. Neck rail **648'** is secured to rail support beam **645'** by a plurality of rail connectors **650'** that extend laterally from beams **645'**. Connectors **650'** have an elbow-shaped profile and extend upwardly above the plane of track rails **642'** to support neck rail **648'** above the track rails.

To ensure the smooth flow of bottles along neck rail **648'**, the end of rail **648'** proximal to the end of first track assembly **640** may have a radiused curve **649'**. A distal end of the rail is bent into a circular shape that extends downwardly past and below the end of track rails **642'**. When a bottle is thrust onto second track assembly **640'**, rail **648'** presents a smooth surface to transition and urge the bottle to an aligned position on second track rails **642'**.

To prevent lateral migration of the bottles from the bottom end side of the bottles, bottom guide rail **656'** is positioned above, and lateral to, track rail **642'** on the side opposite neck rail **648'**. Do to the substantially planar surface of the bottle bottom surface, bottom guide rail **656'** is positioned higher than neck rail **648'** to provide better support for the relatively larger bottom surface. Bottom rail **656'** may be positioned to contact the bottles throughout their travel along track assembly **640'**, or may be positioned to leave a relatively small gap between the bottle and rail to reduce or eliminate frictional resistance to bottle movement.

In an embodiment where bottom guide rail **656'** is positioned toward the back of the apparatus, rail **656'** is secured directly to the apparatus frame rather than rail support beam **645'** as shown in FIGS. **40** and **41**. Alternatively, bottom guide rail **656'** can be connected and supported by rail support beam **645** with the use of rail connectors as used for neck rail **648'**. An end of bottom rail **656'** proximal to first track assembly **640** is secured to the apparatus frame via welding, mechanical fasteners and the like. It may be secured directly to a frame member, or separated as its positioning may require. It can end as a blunt rod, or include a radiused curve to provide a smooth transitional surface to receive a bottle migrating onto second track assembly **640'**.

It should be understood the orientation of the guide rails relative to the apparatus is dictated by the orientation of the bottles placed on the conveyor system. In an alternative embodiment, the necks of the bottles can be oriented toward the back of the apparatus whereby the guide rails are reversed with the neck rail positioned toward the back of the apparatus and the bottom rail positioned toward the front of the apparatus. Either configuration should be well within the contemplation of this disclosure and fully understood by those having ordinary skill in the art.

As shown in FIGS. **39** and **41**, an inertia restrictor support beam **658'** is secured above track assembly **640'** to support inertia restrictors **660'**. Beam **658'** is secured to the apparatus via cross beam **646** and supported at a distal end by cross rod **662**. Cross rod **662** is positioned on, and secured to vertical frame member **643** to align cross beam **646** in a substantially parallel orientation to the plane occupied by second track assembly **640'**. Suspended from beam **658'** are inertia restrictors **660'** that include brush-like bristles **664'** configured and positioned to contact bottles and reduce the inertia of bottles traveling past the restrictor as well as to align empty bottles with track assembly **640'**. Bristles **664'** may be constructed from synthetic materials that exhibit little or no movement memory so as to return to a start position after flexing from the force imparted by a passing bottle. To provide further control over the amount of inertia restriction imparted onto the bottles, one or more inertia restrictors may be secured to beam **658'** via hinge **666'**. Hinged restrictors as shown in FIG. **39**, allow additional resistive force to be applied to bottles without halting forward progress of the bottles based upon gravity driven motion.

Location of the inertia restrictors **660'** is driven by a need to align empty bottles as they travel along the conveyor path. It has been discovered that placement of inertia restrictors is particularly advantageous if placed at or in close proximity to the end of a track assembly such as second track assembly **640'**. This allows sufficient kinetic energy to be drawn from the empty bottle to allow a smooth transition to a lower track assembly when the bottle enters radiused track assembly transition guide rails **668'**. As can be seen in the drawings, once in the transition guide rail area, the bottle experiences a moment of free fall that dramatically increases its kinetic energy that is, in part, imparted to the immediately preceding bottle. An additional inertia restrictor **660'** may also be secured at, or in close proximity to, the beginning of a track assembly to reduce the kinetic energy generated in the transition area. Further inertia restrictors **660'** may be located along a track assembly and may be spaced approximately two bottle widths apart in one configuration. More inertia restrictors may be placed on the lowest most track assembly as that is where kinetic energy buildup is greatest.

Referring to FIGS. **45** and **46**, a third and fourth track assembly are shown positioned below second track assembly **640'**. Third track assembly **640"** is constructed from substantially the same components as first track assembly **640** with the notable exception the leading end of the third track assembly has substantially the same radiused or turned bottle rail guide ends as its trailing end. As with second track assembly

640', this substantially mirror image configuration conforms with one of the primary purposes of third track assembly **640"** as a transitional track assembly that allows bottles, filled or empty, to transition from the first track assembly to lower track assemblies and ultimately, to elevator **702**. And, of course, the slope or grade of third track assembly **640"** is opposite that of second track assembly **640'** and substantially the same as first track assembly **640** to continue the gravity assisted migration of bottles from the high point of first track assembly **640** to the end of fourth track assembly **640"'**.

More specifically, third track assembly **640"** comprises third track rails **642"** configured to be substantially parallel and spaced to substantially match the spacing of the annular channels formed on the outside of the bottles. Rails **642"** may be coated also with a lubricous surface treatment such as Teflon® to reduce frictional resistance of bottle travel. Rails **642"** may be constructed from steel, iron-based materials, engineering-grade plastics and the like. Bottles introduced into the apparatus travel along track rails **642"** by engaging the rails with the annular channels. This interaction assists in the alignment of the bottles as they travel along the track system.

Track rails **642"** are secured to third support plates **644"**. A single support plate **644"** may secure both rails to the apparatus, or two plates may be used, each dedicated to a single rail. Support plates **644"** are secured to rail support beams **645"**, which lie substantially below track rails **642"** and are intersected by substantially orthogonally oriented third cross beams **646"**. Cross beams **646"** are secured, in turn, to the apparatus' internal framework—including vertical frame members **643**.

To further assist the alignment function of track rails **642"**, a pair of asymmetrically positioned guide rails are provided on either sides of the track rails to prevent lateral migration of bottles as they move along the rails, or while the bottles remain stationary waiting for further advancement along the rail system as bottles are purchased and removed from the apparatus. More specifically, third neck rail **648"** is positioned on the side of track rails **642"** that receives the bottle neck portion of the bottles. Neck rail **648"** is secured to third rail support beam **645"** by a plurality of third rail connectors **650"** that extend laterally from beams **645"**. Connectors **650"** have an elbow-shaped profile and extend upwardly above the plane of track rails **642"** to support third neck rail **648"** above the track rails.

To ensure the smooth flow of bottles along neck rail **648"**, a proximal end of rail **648"** has a radiused curve **649"**. A distal end of the rail is bent into a circular shape that extends downwardly past and below the end of track rails **642"**. When a bottle migrates onto third track assembly **640"**, rail **648"** presents a smooth surface to transition and urge the bottle to an aligned position on track rails **642"**.

To prevent lateral migration of the bottles from the bottom end side of the bottles, third bottom guide rail **656"** is positioned above, and lateral to, track rail **642"** on the side opposite third neck rail **648"**. Do to the substantially planar surface of the bottle bottom surface, bottom guide rail **656"** is positioned higher than neck rail **648"** to provide better support for the relatively larger bottom surface. Bottom rail **656"** may be positioned to contact the bottles throughout their travel along third track assembly **640"**, or may be positioned to leave a relatively small gap between the bottle and rail to reduce or eliminate frictional resistance to bottle movement.

Referring still to FIG. **45** and also now to FIG. **47**, fourth track assembly **640"'** is constructed from substantially the same components as first track assembly **640** with the notable exception the leading end of the fourth track assembly has substantially the same radiused or turned bottle rail guide ends as the trailing end of first track assembly **640** and a trailing end has rail guide ends that terminate against a floor of the apparatus. Alternatively, the ends may also terminate, and be connected to, vertical frame members of the apparatus. Unlike the second and third track assemblies, fourth track assembly **640"'** does not include a substantially mirror image configuration as the purpose of the fourth track assembly is to transition filled bottles from the track assemblies directly to elevator **702**. And, of course, the slope or grade of fourth track assembly **640"'** is opposite that of third track assembly **640"** and substantially the same as second track assembly **640'** to continue the gravity assisted migration of bottles from the high point of first track assembly **640** to the end of fourth track assembly **640"'**.

As can be appreciated by those having ordinary skill in the art, the number of track assemblies can be modified in even increments to increase or decrease the number of bottles the apparatus can accommodate. The number of track assemblies could also be altered in odd numbers, which would require the return segment to be placed opposite the end from which filled bottles are retrieved by customers. The number of tracks will also affect the overall height of the apparatus as well as the return door height. Increases in track assemblies will increase the height of the return door.

More specifically, fourth track assembly **640"'** comprises fourth track rails **642"'** configured to be substantially parallel and spaced to substantially match the spacing of the annular channels formed on the outside of the bottles. Rails **642"'** may be coated also with a lubricous surface treatment such as Teflon® to reduce frictional resistance of bottle travel. Rails **642"'** may be constructed from steel, iron-based materials, engineering-grade plastics and the like. Bottles introduced into the apparatus travel along track rails **642"'** by engaging the rails with the annular channels. This interaction assists in the alignment of the bottles as they travel along the track system.

Track rails **642"'** are secured to support plates **644"'**. A single support plate **644"'** may secure both rails to the apparatus, or two plates may be used, each dedicated to a single rail. Support plates **644"'** are secured to rail support beams **645"'**, which lie substantially below track rails **642"'** and are intersected by substantially orthogonally oriented cross beams **646"'**. Cross beams **646"'** are secured, in turn, to the apparatus' internal framework—including vertical frame members **643**.

To further assist the alignment function of track rails **642"'**, a pair of asymmetrically positioned guide rails are provided on either sides of the track rails to prevent lateral migration of bottles as they move along the rails, or while the bottles remain stationary waiting for further advancement along the rail system as bottles are purchased and removed from the apparatus. More specifically, fourth neck rail **648"'** is positioned on the side of track rails **642"'** that receives the bottle neck portion of the bottles. Neck rail **648"'** is secured to fourth rail support beam **645"'** by a plurality of fourth rail connectors **650"'** that extend laterally from fourth beams **645"'**. Connectors **650"'** have an elbow-shaped profile and extend upwardly above the plane of track rails **642"'** to support neck rail **648"'** above the track rails.

To ensure the smooth flow of bottles along neck rail **648"'**, a proximal end of rail **648"'** has a radiused curve **649"'**. A distal end of the rail remains substantially straight and terminates adjacent to an elevator shaft described below. When a bottle migrates from third track assembly **640"** onto fourth

track assembly **640"**, rail **648"'** presents a smooth surface to transition and urge the bottle to an aligned position on track rails **642"'**.

To prevent lateral migration of the bottles from the bottom end side of the bottles, fourth bottom guide rail **656"'** is positioned above, and lateral to, track rail **642"'** on the side opposite neck rail **648"'**. Do to the substantially planar surface of the bottle bottom surface, bottom guide rail **656"'** is positioned higher than neck rail **648"'** to provide better support for the relatively larger bottom surface. Bottom rail **656"'** may be positioned to contact the bottles throughout their travel along third track assembly **640"'**, or may be positioned to leave a relatively small gap between the bottle and rail to reduce or eliminate frictional resistance to bottle movement. No inertia restrictors are required for fourth track assembly **640"'** as the assembly is filled with bottles, full or empty at all times. The bottles act as their own inertia restrictors by taking up space on the track assembly.

Referring now to FIGS. **51** and **54**, a bottle vending gate assembly is shown generally as **740**. Gate assembly **740** includes bottle restrictor assembly **742** that includes a bottle restrictor plate **744** configured as a partial cylinder to provide a nesting surface for the lead-most bottle to register against with a large contact area to disperse the force exerted by the lead-most bottle and subsequent bottles pressing against the lead-most bottle. This ensures no particular area of the lead-most bottle is bearing the weight of the entire train of bottles.

Restrictor plate **744** is attached to gate axle **748** secured at each end to gate bearing assemblies **752** attached to the apparatus framework. One end is connected to gate motor **745** which rotates restrictor plate **744** from open and closed, (bottle restriction), positions. Motor **745** may be a Molon 24v gear motor (McMaster Carr, New Brunswick, N.J.). A rectangular arrestor tab **746** is attached to axle **748** and extends upwardly, in a general direction away from restrictor plate **744**. Tab **746** is configured to engage features of gate lock rod **754** that comprises the remainder of gate assembly **740**. Restrictor assembly rotates from a closed, bottle-arresting position to an open position that permits bottle migration from the track assemblies to an elevator assembly described below.

To control the operation of restrictor assembly **742**, lock rod **754** includes features to engage restrictor assembly **742** to either lock assembly **742** in a closed position when engaged, or allow the free rotation of assembly **742** when disengaged. As shown in FIG. **54**, rod **754** includes a lock rod shaft **764** secured to bearings **756** positioned at either end of the shaft. A restrictor pin **760** is attached to a lower edge of shaft **764** and extends downwardly from the shaft. A pair of limit pins **758** placed proximal to the ends of shaft **764** extend upwardly from the shaft and are configured to engage limit switches, such as those made by Eaton Corporation (Windsor, Conn.) to ascertain the spatial orientation of lock rod **754** relative to restrictor assembly **742**.

Rod **754** translates laterally to perform the locking and unlocking functions. When translated in an extreme position in one direction, restrictor pin **760** engages arrestor tab **746** and locks restrictor assembly in a closed position. When translated in the extreme opposite direction, pin **760** is disengaged from arrestor tab **746** so as to allow the free movement, i.e., rotation, of restrictor assembly **742**. When reaching either extreme location, one of the limit pins will register against one of the prepositioned limit switches that results in a signal being sent to the processor to identify the current location and orientation of rod **754**.

Translational movement of lock rod **754** is accomplished by rod motor **761**. Locking and unlocking restrictor assembly **742** is coordinated by the processor to ensure a lock mode is achieved when assembly **742** is in a closed gate orientation. To achieve this result, the processor coordinates the function of rod motor **761** and gate motor **745**. Motor **761** may be a Molon 24v gear motor

In an alternative embodiment shown in FIGS. **89** and **92**, a pivoting bottle arrestor rod assembly **743***a* may be used to control migration of bottles **2** onto elevator assembly **702**. Assembly **743***a* includes arrestor rod **744***a* secured with a pin or like item to a frame member **643** so as to allow rod **744***a* to rotate freely about the pin. A distal end of the rod has a bottle registration knob **743** that contacts a bottle **2** behind lead-most bottle **2** to prevent its migration into the lead-most position. A proximal end of the rod is connected via pin or like item to slide bar **747** which translates vertically via a motor (not shown). This end of rod **744***a* may pivot relative to slide bar **747** as the slide bar translates vertically. A bottom end of slide bar **747** has a second knob **749** configured to arrest movement of a lead-most bottle **2**.

When slide bar **747** is in a down position, second knob **749** registers against lead-most bottle **2** and prevents the bottle from migrating into the elevator area. In this position, knob **743** is positioned above the second bottle out of contact with the bottle. When slide bar **747** is translated vertically upwardly, second knob **749** is removed from lead-most bottle **2**, which migrates into the elevator area. Knob **743** is simultaneously rotated downward into contact with the second bottle **2** to prevent it from migrating into the first position. To prepare second bottle **2** for delivery to the elevator area, slide bar **747** is translated vertically upwardly for a second time in the cycle, which allows second bottle **2** to migrate into the first position where its movement is arrested by registration against second knob **749**. The two-step process is repeated for each bottle to ensure controlled movement of the bottles from the second position to the first position to the elevator area.

Referring now to FIGS. **50** and **53**, a combination bottle elevator and bottle retrieval door assembly is shown generally as **700**. Assembly **700** includes elevator assembly **702**, elevator vertical guide **718** and bottle retrieval door **726**. Elevator assembly **702** is configured and dimensioned to receive multiple size bottles including, but not limited to, three gallon and five gallon bottles have a substantially cylindrical shape. Elevator assembly **702** includes a substantially rectangular shell **703** with a front end open to allow bottle retrieval and a side, proximal to the track assemblies, open to receive bottles from the track assemblies.

Shell **703** includes a slot **706** configured and dimensioned to allow the free passage of a bottle ejection rod **782** described below. Slot **706** may extend partially into a top surface of shell **703** and extend continuously through a back end **716** and still continuously and partially through a bottom surface. Due to the configuration and orientation of ejection rod **782**, the portion off the slot formed in the top surface may be longer than the slot formed in the bottom surface.

Secured to the bottom surface of shell **703** are substantially parallel spacer tubes **708**. Tubes **708** may be hollow or solid, and are spaced so that the distance between the spacer tubes are less than the largest cross-sectional diameter of the bottles to be carried by elevator assembly **702**. Tubes **708** are dimensioned lengthwise to span substantially the entire length of shell **703**, but may be configured shorter so long as the length is sufficient to stably support any bottle carried by elevator assembly **702**. The height of the tubes is dimensioned to ensure no part of a bottle carried by elevator assembly **703** rests upon the bottom surface of shell **703**, or only contacts the bottom surface at a tangential point along the circumference of the carried bottle.

Secured to top surfaces of tubes **708** are bottle support rails **712**. Rails **712** are substantially cylindrical in shape and provide a lubricious surface to facilitate movement of water bottles parallel to the longitudinal axis of the rails. Rails **712** are spaced a distance less than the largest cross-sectional diameter of any bottle used by the apparatus. This ensures the rails "carry" the bottles rather than act as position restriction devices by pinning the bottle between the rails. By setting the distance less than the cross-sectional diameter, the entire bottle and its contents will be supported by the rails. Rails **712** may be hollow or solid, and are configured with upturned ends proximal to the shell **703** open front end. The upturned ends prevent bottles from being launched from elevator assembly **702** by ejector rod **782**. By design, the application of manual force is required to remove a bottle from elevator assembly **702**. In an alternate embodiment, support rails **702** may be integral to tubes **708**, and in a further alternate embodiment, may be integral to shell **703**. Any engineering grade plastic, metal or metal alloy may be used in the construction of shell **703**, tubes **708** and support rails **712**.

Secured to a side wall opposite the open side wall is optional bottle movement restriction plate **704**. Plate **704** is configured as a partially cylindrically shaped that substantially conforms to the outer cylindrical shape of a water bottle. Plate **704** provides a motion restriction surface against which a bottle moving with kinetic energy off the track assemblies will register against and become deposited on support rails **712**.

Secured to the back end **716** of shell **703** are a plurality of rollers **714**. To provide directional stability and to counter torsional forces that may be imparted on elevator assembly **702** by a bottle containing water and having a shifting center of gravity due to water movement, at least two sets of rollers are used with one set being positioned in closer proximity to the shell top surface than the second roller set. Rollers **714** are dimensioned to roll within roller slots formed in vertical guide **718**. Rollers **714** may be constructed from any lubricous material that reduces frictional resistance while translating along vertical guide **718**.

Vertical guide **718** is dimensioned and configured to provide a support system to allow for the vertical movement of elevator assembly **702** from a downward load position to an upward unload position. Guide **718** includes a pair of substantially vertical beams **720** having portions defining slots for receiving rollers **714**. The slots are dimensioned to allow for the substantially friction-free movement of rollers **714** along the length of the slots.

Beams **720** are connected with horizontal spacers **722** dimensioned to set the distance between the beams to accommodate the spacing of rollers **714**. A plurality of brackets **724** positioned on lateral edges and ends of beams **720** provide a means to secure guide **718** to vending apparatus **620**. As should be understood by those having skill in the art, brackets **724** may be secured to beams **720** in a wide variety of configurations to accommodate the structural components of apparatus **620**.

In an alternative embodiment, a single vertical beam may be used with a single set of rollers to provide for vertical translation of elevator assembly **702**. In this embodiment, at least two rollers having a vertical orientation are used to ensure proper alignment of elevator assembly **702** while translating along beams **720**.

Suspended above and in contact with elevator assembly **702** is retrieval door **726**. Door **726** is substantially rectangular in shape with a pair of door beams **728** secured to a back side along opposing lateral edges. Door rollers **730** are secured to lateral edges of door beams **728** to control and facilitate vertical translation of door **726** when travelling vertically with elevator assembly **702**. Door rollers **730** roll within a pair of beams having portions defining slots to receive door rollers **730**. The construction of the beams is similar to that of beams **720**.

Door **726** does not have a dedicated power source to effectuate door elevation and descent. Vertical operation of door **726** is controlled by movement of elevator assembly **702**. A bottom edge of door **726** registers against the top surface of shell **702**. When elevator assembly **702** of lifted upwardly by a winch (described below), elevator assembly **702** urges door **726** in the same upwardly direction. When elevator assembly **702** is lowered by reversing the winch, door **726** descends via gravitational force. By refraining from using powered operation of door **726**, a customer's hand placed into elevator assembly **702** to retrieve a bottle will not be subjected to an impingement injury with power-actuated closure of door **726**.

As shown in FIG. **50**, elevator movement is performed by a motorized winch **830** assembly, which may include a 12 volt DC type motor **832** such as those produced by Harbor Freight (West Springfield, Mass.). Winch **830** is secured to the apparatus frame above the vertically oriented service area of elevator assembly **702**. A steel cable **834** (shown in FIG. **88**), secured to an axle extending from motor **832** has a distal end attached to an eyelet **838** secured to a substantially horizontal cable support beam **713** secured to back end **716**. The means to secure cable **834** to elevator assembly **702** may be any connection means well known in the art including direct fusion to support beam **713** via welding and the like. Power for motor **832** may be derived from a 12vDC batter such as those manufactured by NAPA. A trickle charger that draws electricity from the attached 120V current may be used to maintain the battery's charge. The Schumacher trickle charger available at department stores such as Wal-Mart may be used for this purpose.

Winch assembly **830** is controlled by a series of sensors that sense and report elevator location and loading. A down limit sensor **715** is placed at the bottom of the elevator shaft to detect when elevator assembly **702** is at its lowest-most point of travel. Location of elevator assembly **702** at this point is a precondition for operation of bottle gate and lock assembly **740** described above. Limit sensor **715** is triggered by mechanical engagement of the sensor's switch trigger by elevator assembly **702**. Once triggered, a signal is sent to the processor so as to allow gate operation for the next bottle-advance event to load the elevator. It should be understood that it is in the scope and contemplation of the disclosure that any of the mechanically triggered switches may be replaced with other sensing devices such as infra-red switches and the like.

Once a bottle is advanced past the vend gate assembly, a bottle sensor **719** secured to elevator assembly **702** is triggered and a signal is sent to the processor to set a "bottle-present" condition. Elevator assembly **702** remains at the lower-most position until a vend event is initiated by a customer. Once a successful purchase transaction is completed, a signal is sent from the processor to initiate ascension of elevator assembly **702** via winch assembly **830**. Elevator assembly **702** ascends until an upper limit sensor **717** is triggered by mechanical engagement with elevator assembly **702**. Sensor **717** is positioned at the elevator's upper limit of travel, which places the bottle carried by the elevator in position for removal by the customer. Once triggered, sensor **717** sends a signal to the processor, which, in turn, sends a signal to winch assembly **830** to stop elevating elevator assembly **702**.

As elevator assembly rises, the resident bottle **2** engages ejection rod **782** shown in FIGS. **62** and **63**. Rod **782** includes

a main body **784** with attachment tabs **788** and **786** located at the extreme ends of the rod. Rod **782** is constructed with an arc configuration in side profile with a bottom positioned toward the back of the apparatus and a top positioned in close proximity to the front of the apparatus. This configuration, in combination with the upward movement of the elevator assembly **702**, causes bottle **2** to engage rod **782** that urges bottle **2** toward the front of apparatus **10** on support rails **712**. This positions the bottle to facilitate manual removal from elevator assembly **702**. Once removed, weight sensor **719** positioned at the bottom of elevator shell **703** is activated to send a signal to the processor to confirm removal of bottle **2**. This resets the vending apparatus for the next transaction as described more fully below.

In an alternate embodiment shown in FIGS. **145** and **146**, an ejector plate **782'** is used in place of rod **782**. Plate **782'** has a radiused edge **783** that conforms to the basic shape of rod **782** and provides the same function, i.e., to urge bottle **2** toward the front of elevator assembly **702** as elevator assembly **702** ascends. A sensor **779** is positioned on edge **783** to detect the presence of bottle **2** on elevator assembly **702**. After bottle **2** is removed from the elevator, a signal is sent back to the processor to confirm the bottle's removal so as to initiate another vend cycle by lowering elevator assembly to the start position.

As shown in FIGS. **55-57**, a pair of loading ports **766** configured in the form of metallic tubes are used to provide a means to move and transport apparatus **620**. Tubular steel may be used for this purpose. Ports **766** are dimensioned and spaced to receive the forks of a fork lift truck so as to facilitate the controlled movement of the apparatus. Ports **766** may extend the entire front-to-back dimension of the apparatus and be open at both the back and front ends to allow variability for placement of the apparatus either on a transportation vehicle, such as a flatbed truck, or for placement in a particular location that may require a specific orientation of access.

Referring now to FIGS. **64-66**, an apparatus leveling device is shown generally as **790**. Device **790** includes a mounting plate **794** configured for attachment to a bottom of apparatus **620**. Mechanical fasteners, welding and the like may be used to secure plate **794** to apparatus **620**. A threaded foot rod **792** is provided as a means to impart adjustability to leveling device **790**. Plate **794** has portions defining a threaded bore (not shown) dimensioned and configured to receive foot rod **792**. The threading of foot rod **792** engages the threading of the plate bore. Torquing the rod in either direction will either raise or lower the device relative to apparatus **620**. A pair of threaded nuts, **800** and **802**, may be included to lock the vertical orientation of rod **792** relative to plate **794** by registering the nuts against plate **792** and each other in a method of locking a threaded rod in place well known in the art.

Appended to a bottom end of rod **792** is foot pad **796**. A pad frame **798** may be included as a junction between rod **792** and pad **796**. Pad **796** may be secured to frame **798** with mechanical fasteners, or may be connected via any other means known in the art such as welding. Pad **796** may be circular in shape, or may conform to any regular or irregular geometric pattern. A bottom surface of pad **796** may be made smooth and planar, or may be formed with knurls or other surface treatments to impart better grip and traction when placed on a variety of surfaces.

Referring now to FIGS. **71** and **72**, an outer shell of apparatus **620** is shown. In one embodiment, the outer shell is comprised of a series of metal sheets, each custom fit to specific segments of the apparatus. Alternatively, the outer shell may be fabricated with other materials such as fiber glass and carbon-based composites. These latter materials provide an additional benefit of being electrically neutral and unable to carry electric current.

Positioned on the interior of the shell is insulation which may be configured in a variety of forms including foam sheets, bat insulation, sprayed foam and the like. To ensure the enclosed water remains in fluid form, particularly in colder climates, complete insulation of the exterior surfaces should be achieved. The importance is diminished in warmer climates although the apparatus may be configured for refrigerated use with the addition of refrigeration equipment as is well known in the art.

Referring now to FIG. **52**, heating and venting may also be incorporated into apparatus **620**. A resident temperature sensor **735** is connected to a programmable heater **732** and impeller **734** to maintain apparatus **620** above freezing temperatures in cold weather and to circulate air in warmer temperatures to help protect the electronic components of the apparatus. For this purpose an 880W 120vac McMaster heater may be used (McMaster Carr, New Brunswick, N.J.). A McMaster 120vac heater fan may also be used.

Referring to FIGS. **134-139**, LED lighting may be affixed to soffit surfaces of apparatus **620** to provide night time illumination of the entire unit and the loading and unloading features in particular. For this purpose, LED lights from Elemental Led Company, Emeryville, Calif. may be used.

As shown in FIG. **71**, apparatus **620** includes a pair of access doors **810** configured to open in opposing directions. Doors **810** provide access to the track assemblies to allow the removal of empty bottles **3** and the placement of filled bottles **2**. A bottle removal slot **780** is formed in a front face of apparatus **620** in alignment with the elevator shaft and oriented to be substantially planar with elevator shell **703** when in an upper most orientation. This orientation permits customers to retrieve filled bottles when a transaction has been successfully accomplished. As previously described, the upward movement of elevator assembly **702** causes a corresponding upward movement of retrieval door **726** that occludes removal slot **780** when in a closed position. Removal slot **780** may be configured with a reduced diameter upper portion with continuously radiused edges to prevent impingement injuries when retrieving a filled bottle **2** from elevator assembly **702**.

Referring to FIG. **72**, a side wall of apparatus **620** is shown. Return door **622** is positioned in this side wall above customer interface touch screen **772**. In an alternate embodiment shown in FIGS. **73** and **74**, return door **622** is positioned on the front wall above removal slot **780**. This "front return" embodiment requires empty bottles **3** are loaded bottom first to align the bottles for transfer to first track assembly **640**.

Referring now to FIGS. **75** and **76**, a solid body inertia restrictor **660'** is suspended from hinge **666** attached to beam **658**. Restrictor **660'** is weighted to counter kinetic energy buildup in return bottle **3**. Hinge **666** is preloaded to return to a start position after passage of bottle **3**.

Referring now to FIGS. **77**, **78** and **81-86**, speed bump inertia retrictors **820** are shown. Restrictors **820** provide a traversable inertia-limiting barrier to reduce kinetic energy buildup in bottles traveling along the graded track assemblies. Each speed bump inertia restrictor is secured to track rails **642** in a substantially orthogonal orientation to the track rails. Restrictor spacing may be set at approximately twice the cross-sectional diameter of bottle **2**. Other spacing may be used to tailor the velocity at which bottles travel down the track assemblies. The thickness of restrictors **820** may be varied to increase or decrease bottle kinetic energy reduction. In general, thinner restrictors will impart less kinetic energy

reduction while thicker restrictors will impart greater kinetic energy reduction. In one embodiment shown in FIGS. **84** and **86**, leading and/or trailing edges of restrictors **820** may be beveled to provide a smoother transitional surface for bottle traversal.

FIG. **78** shows one embodiment of the guide rails with a radius of 11.5 inches throughout the turn. As shown in FIG. **79**, guide rails from the start of the curve to the end of the curve may be 23 inches. These dimensions have proven effective to guide the movement of both 3 gallon and 5 gallon water bottles. As should be understood by those having ordinary skill in the art, the dimensions may be modified to accommodate different sized bottles having different cross-sectional diameters.

In another aspect of the disclosure as shown in FIGS. **90**A and **90**B, a combined bottle vending/bottle return application is shown generally as **859**. The application begins with the customer approaching and operating the vending machine touch screen **772**. Screen **772** is configured to receive credit/debit cards and/or prepaid purchase cards purchased from the retailer adjacent the vending apparatus. In one embodiment, the customer is first presented with a welcome screen at step **860**. The welcome screen is shown generally as **956** in FIG. **91**A. Welcome screen **956** includes information about purchase options with and without return bottles. The ability to change the displayed price is available in the touchscreen software. The customer is also prompted to select a language among choices shown on the touch screen at step **862**. Once a language has been selected, all further screen prompts are shown in the selected language. For purposes of illustration and not limitation, the drawings show English and Spanish as language selections. The application may be programmed for any combination of languages desired by the apparatus owner/licensee.

The customer is next prompted to select a purchase option at step **864**. In the illustrative embodiment, two selections are provided: 1) a bottle purchase without a return **866**, and 2) a bottle purchase with a return **868**. The selection of one of the purchase options will lead to a dedicated series of further prompts and customer initiated steps.

Should the customer select the bottle-only (shown as option 1), option **866**, depending on the configuration, the customer is prompted to touch, insert, or slide a credit/debit/prepaid water card in the reader at step **870**. The customer is also provided with a cancel option at this step, if needed. The screen display may be substantially like that shown as **968** in FIG. **91**A. If the attempt to engage the reader is unsuccessful, the customer is prompted to try again after a predetermined time period to read the card information lapses. The system may be configured to allow for a predetermined number of tries to have the card read before the system declines to read the card.

If after successfully swiping the card, the customer wishes to cancel the transaction, the customer can cancel the transaction by the selecting the cancel option at step **872**. The screen will display the transaction has been canceled. If the customer does not select the cancel option, the system processor sends an electronic signal to the customer's financial institution to request transaction authorization at step **874**. The customer will have the option to cancel the transaction again at step **874**. While the application is seeking authorization, the screen may include a display such as that shown as **970** in FIG. **91**A. If canceled, the screen will display the cancellation at step **876**. A message may be displayed on screen **772** substantially similar to that shown as **984** in FIG. **91**C.

If the transaction is declined, screen **772** displays a "credit authorization declined" message at step **924** and further instructs the customer to try another card, or contact their financial institution. The displayed message may also be substantially similar to that shown as **982** in FIG. **91**C. The system returns to the home screen **860**. If, at any point, the application fails for any reason, a message may be displayed on screen **772** substantially similar to that shown as **980** in FIG. **91**C.

If the transaction request is approved, the system debits the designated amount from the customer's account at step **878**. The screen will display a "transaction complete" notification to inform the customer of the successful electronic transaction. A screen message may be displayed substantially similar to that shown as **972** in FIG. **91**A at this step. Completion of the financial transaction prompts the processor to initiate the full bottle vend function at step **880**. Elevator assembly **702** is operated by activating winch assembly **830** to lift the enclosed full bottle **2** to the designated bottle retrieval zone at step **882**. As the bottle is being elevated, bottle **2** is registered against ejector bar **782** that urges bottle **2** toward the front open end of elevator assembly **702**. Once elevator assembly **702** reaches the predetermined retrieval location, upper limit sensor **717** is triggered by elevator assembly **702** and the bottle is fully within the vend position. With the simultaneous elevation of door **726**, full bottle **2** is ready for customer retrieval. At this step, a message may be displayed on screen **772** substantially similar to that shown as **974** in FIG. **91**A.

Once sensor **717** is triggered and a signal is relayed to the processor, a message is displayed on screen **772** to thank and inform the customer the bottle is ready for retrieval at the front of apparatus **620** at step **886**. The customer retrieves bottle **2** at step **888**. Once the customer removes bottle **2** from elevator assembly **702**, sensor **719** is triggered to confirm bottle removal at step **884**. A preset time delay may be incorporated into the application at this step to ensure the customer is safely removed from the retrieval zone before a signal is sent to begin the elevator assembly descend process at step **890**. Door **726** does not close until sensor **719** is triggered. With removal of the full bottle, a message may be displayed on screen **772** substantially similar to that shown as **964** in FIG. **91**A.

Elevator assembly **702** progresses downwardly until down limit sensor **715** is triggered at step **892**. Sensor **715** sends a signal to the processor regarding the elevator assembly's current location. This prompts the processor to send a "stop" signal to winch assembly **830**. The cessation of winch activity is followed by a signal sent from the processor to the lock motor **745** to disengage lock rod **740** from gate assembly **744** at step **894**. The lead bottle **2** is thus released into elevator assembly **702** to await the next bottle purchase event. Sensor **719** is triggered by the now resident bottle **2** and sends a signal to the processor to confirm the presence of bottle **2** in elevator assembly **702** at step **898** so as to make the bottle available for purchase by the next customer.

If a bottle **2** does not enter elevator assembly **702** when gate assembly **710** is disengaged from lock rod **725**, sensor **719** is not triggered at step **906**. After a preselected time period—from about 0 seconds to about 20 seconds—the absence of a signal from sensor **719** after disengagement of lock rod **725** due to lead bottle **2** not migrating into elevator assembly **702**, an out-of-order message is displayed on screen **772** with, or without, an instruction to contact the bottler, vending company, and/or service department at step **908**.

If an instruction is given to contact the bottler/vendor/service department, and the bottler/vendor/service department is contacted at step **910**, a truck is dispatched to refill or

service apparatus **620**. In an alternative embodiment, the apparatus processor automatically sends a signal via wireless and/or wired methods well known in the art and commonly known to the bottler/vendor/service department to attend to apparatus **620**.

When the last filled bottle **2** is positioned for migration into elevator assembly **702**, a signal is sent to the processor via bottle sensor **777** to identify the last bottle at step **896**. Alternatively, sensor **777** may be set at any point along the track assemblies to indicate any pre-designated number of remaining filled bottles **2**. For example, sensor **777** may be positioned to detect when 10 filled bottles remain in apparatus **620**. A signal is sent to the processor to register the remaining full bottle count. The processor then sends a signal to screen **772** to display a "Sold Out" message with an optional additional message to contact the bottler/vendor. In an alternative embodiment, the processor automatically sends a signal to the bottler/vendor when the "last bottle" signal is received. Automated, or customer initiated contact takes place at step **910**. The automated embodiment ensures apparatus **620** is timely resupplied before more customers make purchases. With either embodiment, a truck is dispatched to fill the apparatus as step **912**.

Referring back to step **864**, if the customer selects the second option, a purchase with a return bottle at step **868**, the customer is prompted to swipe, insert and/or pass the card across the card reader at step **916**. A screen message may be displayed at this step substantially similar to that shown as **958** in FIG. **91**A. The customer is given the option to cancel the transaction at this step and may do so at step **918**. This sends the application back to the start screen **860**.

If the cancel option is not selected, the processor sends a message to the customer's financial institution for authorization to process the transaction at step **920**. The customer is again given the option to cancel and may do so at step **922**. If the cancel option is selected, the application returns to home screen **860**. If cancel is not selected, the application waits for a response to the authorization request. If the authorization is declined, a "credit authorization declined" message is displayed on screen **772** at step **924** and the customer is prompted to try another card, or to contact their financial institution. The application thereafter returns to home screen **860**.

If the authorization is approved and the funds are successfully transferred, a message is displayed on screen **772** indicating the amount paid and the transaction complete at step **926**. Subsequently, or substantially simultaneously, the processor sends a signal to return door lock **623** to initiate a door unlock sequence at step **928**. A message **962** is displayed on screen **772** to prompt the customer to lift the door and properly align and place the empty return bottle **3** inside the return bin with a further prompt to properly align the bottle and close the door when finished at step **930**. Sensors **638**, **634** and **637** validate the empty bottle as being the correct size bottle (for example a 5 gallon bottle), at step **932**. The message displayed on screen **772** at this step may be substantially similar to that shown as **962** in FIG. **91**A. It should be understood that apparatus **620** may be configured to accommodate a single size bottle, multiple size bottles in a range from about 1 gallon bottles to about 5 gallon bottles.

If the bottle is not accepted at step **940**, a message is displayed on screen **772** to indicate the bottle is invalid and to prompt the customer to remove the bottle and try again at step **942**. The customer is also given the option to cancel the transaction. A message may be displayed on screen **772** at this step substantially similar to that shown as **976** in FIG. **91**B. If the customer selects the cancel transaction option, a transaction cancelled message is displayed on screen **772** at step **952** and the application returns to home screen **860**. As no funds are transferred until the bottle is successfully removed from the apparatus, any cancellation procedure that takes place prior to bottle removal will not result in a fund transfer event that eliminates the need to institute a refund sequence.

If the customer elects to retry, the customer removes the bottle and realigns it with the bottle form and deposits it a second time at step **944**. If rejected again, an invalid bottle message is displayed on the screen at step **950**. The message may include a further prompt to try again as well as a cancellation option. If the customer selects the cancellation option, a "transaction cancelled" message is displayed at step **952**, and the application returns to home screen **860**.

If a third attempt is made to deposit a return bottle, the customer again removes the return bottle, realigns it with the return bottle form and deposits the bottle in a repeat of step **944**. If the return bottle is rejected yet again, a message is displayed on screen **772** indicating invalid bottle 3$^{rd}$ attempt at step **946**. If the application is set for three tries, an "invalid bottle, transaction cancelled" message is displayed on the screen at step **948** and the application returns to home screen **860**. A message such as that shown as **978** in FIG. **91**B may be shown at this step if no more tries are allowed. If set for more than three tries, the application returns to step **944** for another try. If the third attempt is successful, the application proceeds to step **932** where the sensors validate empty bottle **3**.

Once a return bottle has been accepted, a signal is sent by the processor to lock return door **622** with door lock **623** at step **934**. Sensor **635** detects whether the return door is locked and sends a corresponding signal to the processor. The processor next sends a signal to cradle motor **633** to rotate cradle **624** to deposit the return bottle onto track assembly **640** at step **936**. Cradle motor **633** continues to rotate toward track assembly **640** until sensor **636** is tripped, which sends a signal to the processor that the cradle has reached maximum rotation to deliver the return bottle at step **938**. At the same step, the processor sends a signal to motor **633** to reverse direction and return cradle **624** to a "home" or start position, ready to receive the next return bottle **3**. The application next initiates step **880** to initiate the full bottle **2** vend sequence previously described. Screen messages substantially similar to those shown as **964** and **966** in FIGS. **91**A and **91**B, respectively, may be displayed following step **880**. FIGS. **90A1-90C1** show an alternative combined bottle vending/return application that may be used with the disclosed vending/return apparatus embodiments. The alternate application steps are self-evident as set forth in the drawings.

Referring now to FIG. **80**, lower inertia restrictor **660""** is secured between track rails **642** to reduce kinetic energy of bottles **2** and **3** traversing the restrictor. A torsional spring (not shown) returns restrictor **660""** to a start position.

In a yet further aspect of the disclosure, the track assemblies are modified with substantially flat boards replacing the rails to provide a solid surface upon which both filled bottles and empty bottles can traverse from the return segment to the elevator segment. In this embodiment, each track assembly is further altered by elevating the side of the track assemblies that support the neck portions of the bottles relative to the side of the track assemblies that support the bottom ends of the bottles so as to create a lateral angle of incline of the neck portion side. This configuration imparts several benefits as disclosed below.

More specifically, referring now to FIGS. **147-156**, the track assemblies have about a 6° grade from left to right for the first and third assemblies and from right to left for the second and 4$^{th}$ assemblies. Each track assembly also has

about a 4° grade from the neck side of the track assembly to the bottle bottom side. Either grade can be enlarged + or − about 5°. The side angle is particularly advantageous as it solves a problem with leakage from the interface of the bottle and bottle cap.

A first segment **641.5** of the first track assembly does not include the side angle and remains along a horizontal plane to align with the orientation of cradle **624** that deposits the return bottles **3** onto the track assembly. When a return bottle **3** is urged onto the first track assembly, a track ramp **641.7** shown in FIG. **156** prevents the bottle from advancing on the track assembly. Instead, the bottle is urged against the inertia retarding flap **660**, which has a one-way hinge. The bottle is urged up the ramp and onto the declining portion of the track assembly when a second return bottle is urged onto the track assembly by cradle **624**. The side angle transition from the relatively flat first segment to the angled track assembly occurs on ramp **641.7**.

In place of rails **642** and their equivalent structures on the second, third and fourth track assemblies in the prior disclosed embodiment, flat boards such as starboard from King Plastics is used. The boards are of a food-grade quality and are resistant to temperature and pressure fluctuations. This substitution eliminates the need for a neck guide rail when the boards are placed on an angle as disclosed.

The last portion of the fourth track assembly transitions to a substantially flat horizontally planar surface to align the bottle for positioning on the elevator assembly. The entire configuration eliminates the need for any inertia restrictors except for the first restrictor **660** shown in FIG. **156**.

While the present disclosure has been described in connection with one or more embodiments thereof, it will be apparent to those skilled in the art that many changes and modifications may be made without departing from the true spirit and scope of the disclosure. Accordingly, it is intended by the appended claims to cover all such changes and modifications as come within the true spirit and scope of the disclosure.

We claim:

**1**. A combination bottle vending/return apparatus comprising:

a front wall, a back wall, and side walls connecting the front wall to the back wall, the combination defining a single vend/return compartment;

an internal bottle receiving and vending segment having a back wall and comprising at least one column of a plurality of stacked stationary gravity fed linear conveyor assemblies having at least one top stationary linear vending conveyor assembly and at least one bottom stationary linear vending conveyor assembly, wherein the conveyor assemblies support filled or empty bottles and combinations of filled and empty bottles;

a single vend/return door secured to the front wall, wherein the door permits access to the vend/return compartment and permits the retrieval of filled bottles from, and the deposit of empty bottles into, the compartment; and,

a bottle return/bottle vend elevator assembly secured adjacent to the internal bottle receiving and vending segment, wherein the elevator assembly moves along a vertical axis from the at least one bottom vending conveyor assembly to the at least one top vending conveyor assembly, wherein the elevator aligns with the bottom vending conveyor to receive a filled bottle for vending, rises to be substantially aligned with the door to permit filled bottle removal and empty bottle deposit and rises to be substantially aligned with the top conveyor to permit empty bottles, when positioned on the elevator, to migrate from the elevator to the at least one top conveyor assembly.

**2**. The apparatus of claim **1**, wherein the top vending segment conveyor is pitched downwardly from a front end of the apparatus toward a back end of the apparatus.

**3**. The apparatus of claim **2**, wherein the bottom vending segment conveyor is pitched downwardly from a back end of the apparatus toward a front end of the apparatus.

**4**. The apparatus of claim **3**, wherein the top vending conveyor assembly extends from a front wall of the apparatus to a distal point or plane spaced from a back wall of the vending segment wherein the distance between the distal point or plane and the back wall is larger than the cross-sectional diameter or cross-sectional dimensions of a water bottle.

**5**. The apparatus of claim **4**, wherein the bottom vending conveyor assembly extends from the front wall of the apparatus to the back wall of the vending segment.

**6**. The apparatus of claim **5**, wherein the plurality of vending conveyor assemblies, excluding the top vending conveyor assembly and the bottom conveyor assembly, extend from a point or plane spaced from the front wall of the apparatus to a point or plane spaced from the back wall of the vending segment, wherein the distance between the conveyor assemblies from the front wall is greater than the lateral dimensions of a water bottle and wherein the distance between the conveyor assemblies and the vending segment back wall is greater than the lateral dimensions of a water bottle.

**7**. The apparatus of claim **6**, further comprising an identification tag reader secured to the front wall of the apparatus.

**8**. The apparatus of claim **7**, further comprising a shelf secured to the front wall of the apparatus below a bottom edge of the vending retrieval door.

**9**. The apparatus of claim **8**, further comprising a credit/debit/prepaid card reader secured to the front wall of the apparatus.

**10**. The apparatus of claim **9**, further comprising a sensor set in proximity to the return/vend door to sense the removal of a filled water bottle.

**11**. The apparatus of claim **10**, further comprising a sensor set in proximity to the return/vend door to sense the presence of an empty water bottle on the elevator assembly.

**12**. The apparatus of claim **11**, further comprising electromechanically operated door locks for the return/vend door in the apparatus.

**13**. The apparatus of claim **1**, wherein the elevator assembly comprises a shell with a slot formed in at least a back wall of the assembly.

**14**. The apparatus of claim **13**, wherein the apparatus further comprises an ejection rod secured inside the apparatus and positioned to fit within the slot formed in the elevator assembly.

**15**. The apparatus of claim **14** ,further comprising a winch assembly secured to the elevator assembly and a processor secured in the apparatus, wherein the processor controls operation of the winch assembly.

**16**. The apparatus of claim **15**, further comprising a bottle sensor secured in the elevator assembly to detect the presence of a bottle in the elevator assembly.

**17**. The apparatus of claim **16**, further comprising an upper limit sensor secured in an elevator shaft within which is located the elevator assembly, wherein the upper limit sensor detects the presence of the elevator assembly at a designated upper limit of travel.

**18**. The apparatus of claim **17**, further comprising a down limit sensor secured in the elevator shaft, wherein the down limit sensor detects the presence of the elevator assembly at a designated lower limit of travel.

19. The apparatus of claim 18, further comprising a bottle gate and lock assembly secured in the apparatus adjacent to an end of the at least one bottom vending conveyor assembly.

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